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T.O. 33A1-13-8-3

HANDBOOK
OVERHAUL INSTRUCTIONS

SPECTRUM ANALYZER AN/UPM-17

(LAVOIE LABORATORIES)

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

AF-WP-O-8 OCT 56 900

1 AUGUST 1956

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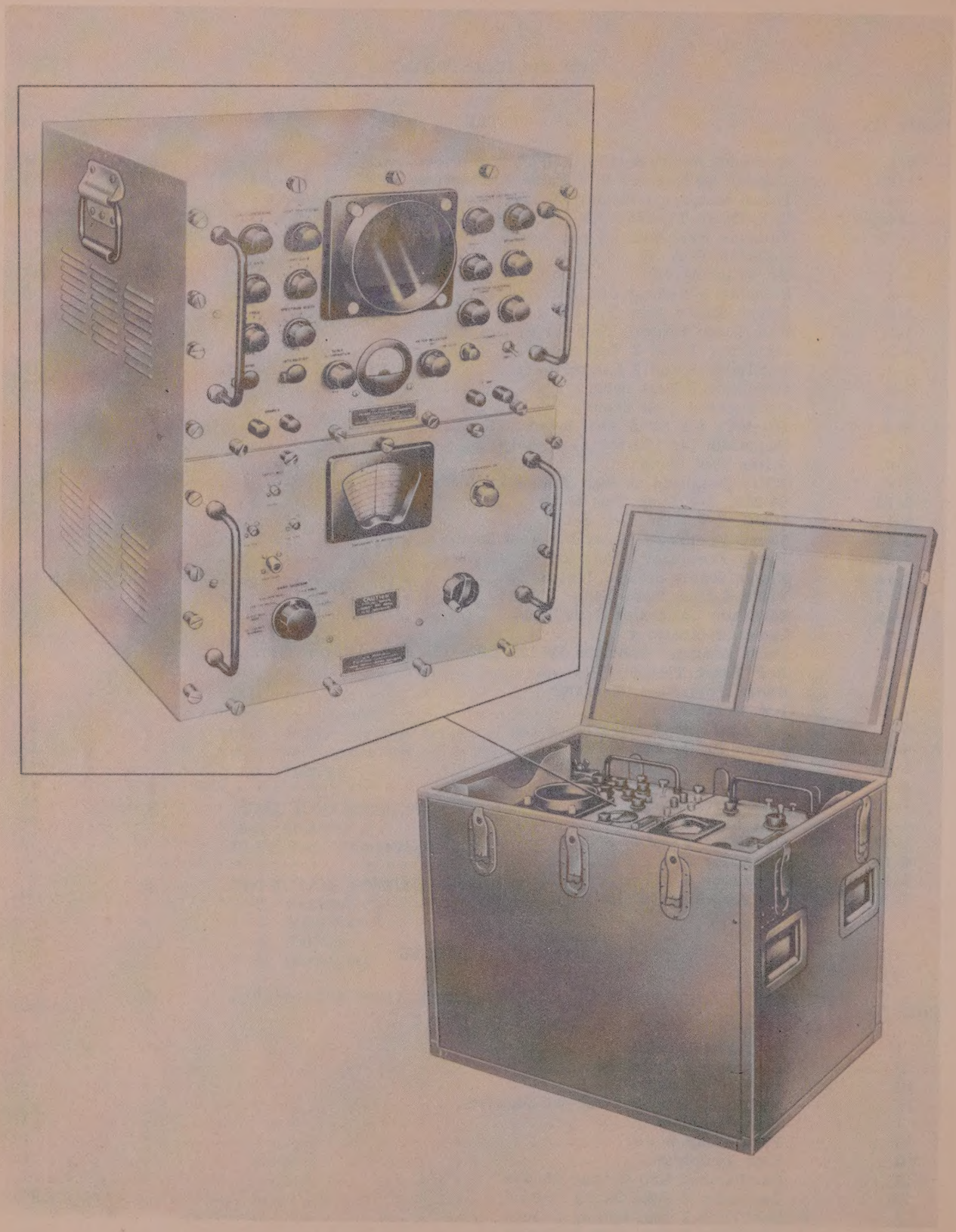


Figure 1-1. Spectrum Analyzer AN/UPM-17

INTRODUCTION

The information contained in this publication is intended for the use of depot maintenance personnel to enable them to overhaul the Spectrum Analyzer AN/UPM-17 so that it will meet new equipment standards of operation. Where the overhaul procedures utilize instructions contained in the equipment's Handbook of Operating and Service Instructions, they are not generally repeated in this publication but are referenced to the service handbook. For a description of assemblies and parts refer to the Illustrated Parts Breakdown for the equipment.

SECTION I

GENERAL DESCRIPTION

1-1. PURPOSE OF HANDBOOK.

1-2. This publication comprises service instructions for the Spectrum Analyzer AN/UPM-17 (figure 1-1), manufactured by Lavoie Laboratories, Incorporated, Morganville, New Jersey.

1-3. SCOPE OF HANDBOOK.

1-4. Sections I through XI of this handbook apply to the Spectrum Analyzer, AN/UPM-17, manufactured under Contract No. AF33(604)-7606. Additional models will be covered in Section XII by the use of Difference Data Sheets. Service instructions for models included in Section XII are the same as the procedures given in Sections I through XI except for the specific differences noted by the applicable Difference Data Sheets.

1-5. PURPOSE AND BASIC PRINCIPLES OF THE EQUIPMENT.

1-6. The spectrum analyzer is an electronic test instrument used to analyze the frequency spectrum and pulse shape of pulsed r-f oscillators employed in radar transmitters. The instrument can be used to check frequency modulation and frequency stability of the r-f oscillator as well as to measure the pulse width and bandwidth of the r-f oscillator pulse. The analysis of pulse shapes is accomplished by viewing the pattern on the cathode-ray tube screen of the analyzer. The pulse pattern represents the distribution in frequency of the r-f power of the pulse.

1-7. The spectrum analyzer is an instrument that incorporates a narrow-band superheterodyne receiver which is physically divided into two major components: the Pulse Analyzer Indicator IP-130/UPM-17 and the R-F Tuner TN-188/UPM. The Pulse Analyzer Indicator IP-130/UPM-17 is actually a complete spectrum analyzer which covers a frequency range from 145 to 175 mc. When the input frequency is 160 mc, and the spectrum width is set at 10 mc, this unit possesses a sensitivity of approximately 10 microvolts for a signal-to-noise ratio of two to one. The R-F Tuner TN-188/UPM is primarily a frequency converter which changes the frequency range of 10 to 16,000 mc to a basic frequency range of 145 to 175 mc. The converted signal from the tuner unit is fed to the indicator unit where it appears as a vertical signal on the baseline of the KRT. This baseline represents a frequency domain. The converted signal is that which is viewed (vertically) on the cathode-ray tube screen on the panel of the indicator unit. The scope pattern produced is a plot indicating power vertically and frequency horizontally, and represents the spectrum of an input signal to the spectrum analyzer.

1-8. To visually display the desired spectrum, the second local oscillator of the analyzer is swept in frequency while the horizontal deflection of the scope

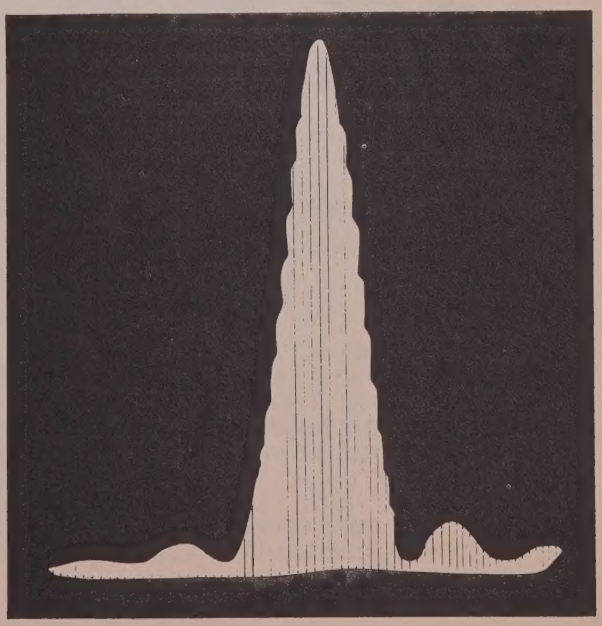
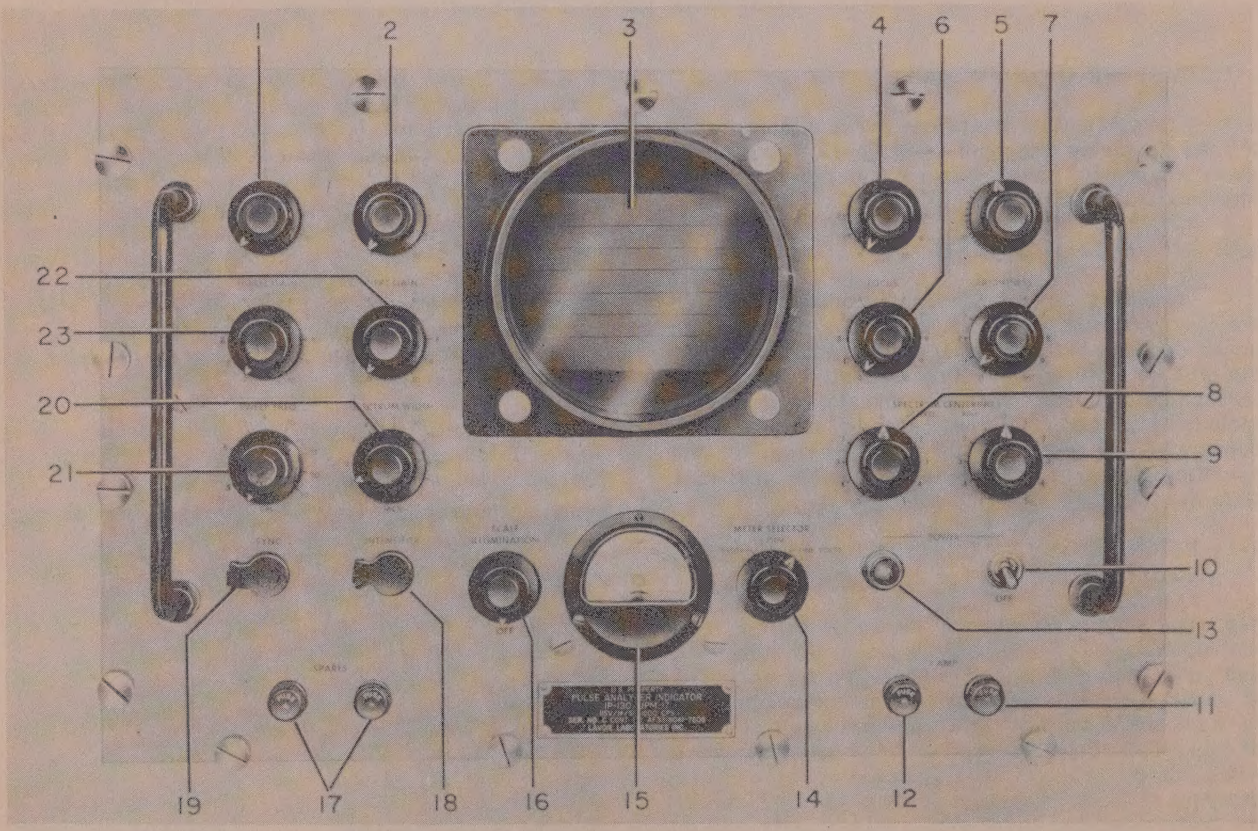


Figure 1-2. Typical Rectangular R-F Pulse Analyzed on Spectrum Analyzer AN/UPM-17

is varied in synchronism. For a pulsed input signal, a succession of transients appears on the screen which resemble a picket fence, and the envelope of the transients is proportional to the power spectrum. For ranges of frequency of the order of 0.5 to 25 mc, the horizontal deflection is accurately proportional to frequency. Figure 1-2 illustrates a one-microsecond rectangular pulse, having negligible frequency modulation, as it appears on the screen of the cathode-ray tube. The illustration reveals the individual transients composing the spectrum.

1-9. DESCRIPTION OF UNITS.

1-10. GENERAL. The spectrum analyzer is designed to operate from a 115-volt, 50-1000 cps power supply. The power consumption is 250 watts, maximum. The instrument is capable of operating in the range of 10 to 16,000 mc. All frequencies are read on one direct-reading illuminated dial with an accuracy of plus or minus one percent. The pulse is analyzed on a five-inch cathode-ray tube. Conventional oscilloscope controls are included to adjust the image for proper analysis. The spectrum width of the pulse can be made to represent a frequency width from 1/2 to 25 mc. A variable amplitude spectrum calibrator (frequency-marker oscillator), with a flat output and a frequency range of plus and minus 15 mc, is provided. The entire instrument is contained in two sliding-drawer units. The two units comprising the analyzer instrument are the Pulse Analyzer Indicator IP-130/UPM-17 and the R-F Tuner TN-188/UPM. A transit case is supplied for storage and shipment of the instrument. Cable assemblies and two variable r-f attenuators are also supplied and are located on the interior of the transit case.



1. "HORIZ CENTERING" knob
2. "VERT CENTERING" knob
3. Cathode-ray tube screen
4. "SPECTRUM CALIBRATOR" - "AMPLITUDE" knob
5. "SPECTRUM CALIBRATOR" - "FREQUENCY" knob
6. "FOCUS" knob
7. "BRIGHTNESS" knob
8. "SPECTRUM CENTERING" - "COARSE" knob
9. "SPECTRUM CENTERING" - "FINE" knob
10. "POWER" switch
11. "3 AMP" fuse
12. "3 AMP" fuse
13. "POWER" indicator lamp
14. "METER SELECTOR" switch
15. Voltmeter indicator
16. "SCALE ILLUMINATION" knob
17. "SPARES" (fuses)
18. "INTENSIFIER" adjustment control
19. "SYNC" adjustment control
20. "SPECTRUM WIDTH" knob
21. "SWEEP FREQ" knob
22. "VERT GAIN" knob
23. "HORIZ GAIN" knob

Figure 1-3. Pulse Analyzer Indicator IP-130/UPM-17, Front Panel View

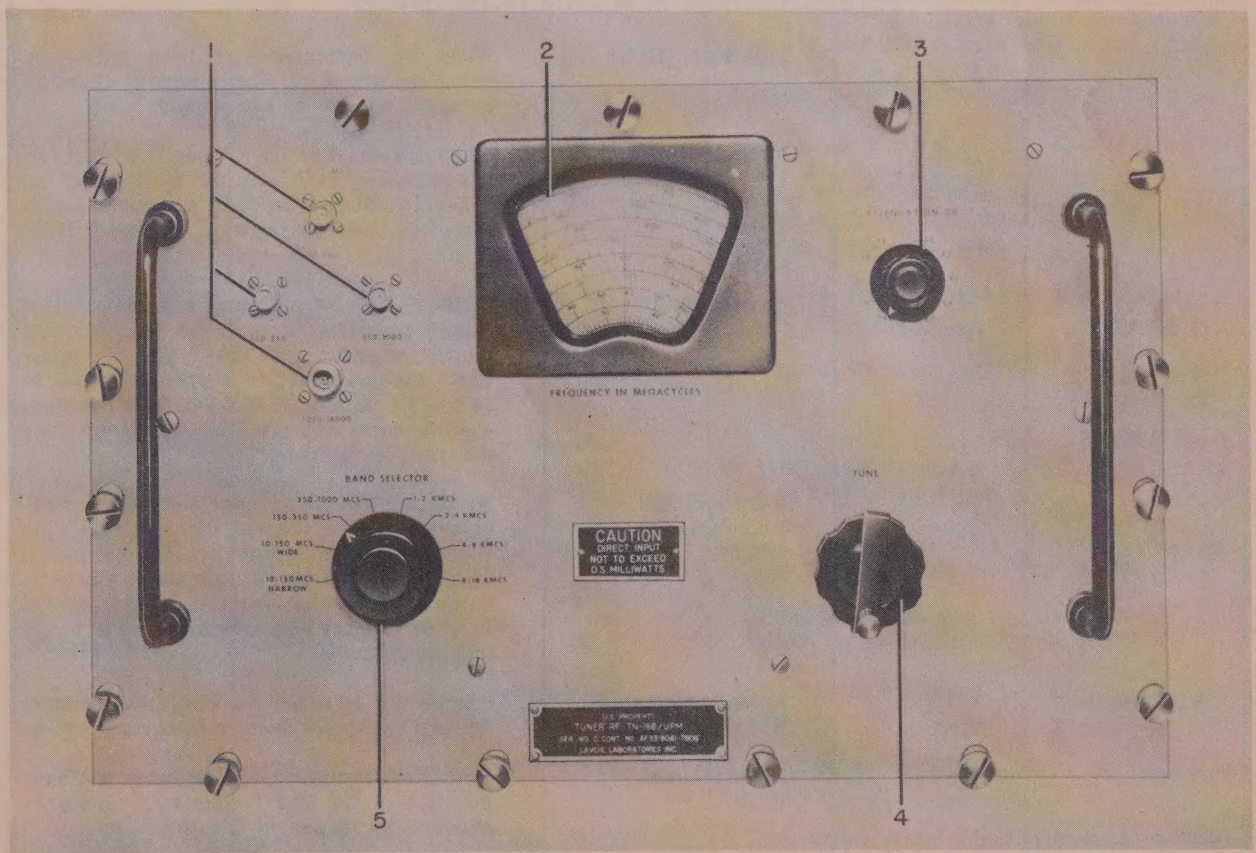
1-11. PULSE ANALYZER INDICATOR IP-130/UPM-17.

NOTE

All panel controls referred to in this handbook are spelled exactly as marked on the equipment.

1-12. Shown in figure 1-3 is a front panel view revealing the location of all operating and adjustment controls on the pulse analyzer indicator unit, which constitutes the upper half of the analyzer instrument. Table I, Operating Controls, describes the function and lists the type and designation of each control. The indicator unit panel primarily consists of a five-inch cathode-ray tube, type 5CP1A, and associated controls to aid in adjusting the various wave shapes viewed for proper analysis. The controls used to accomplish this purpose are "HORIZ CENTERING," "VERT CENTERING," "HORIZ GAIN," "VERT GAIN," "SWEEP FREQ," "SPECTRUM WIDTH," "SPECTRUM CALIBRATOR," "FOCUS," "BRIGHTNESS," "SPECTRUM CENTERING," "SYNC," and "INTENSIFIER." A voltmeter is included on the panel for indicating either the line voltage (115 volts input), i-f amplifier plate voltage, or negative supply potential. The voltages to be read are selectable by use of the "METER SELECTOR" knob. An on-off switch is located on the panel for starting the equipment in operation. Two "3 AMP" input-power fuses are mounted on the panel and can be easily removed and replaced, if defective. Two spare fuses are provided for maintenance purposes. The two covered screwdriver-adjustment potentiometers "SYNC" and "INTENSIFIER" are included for conviently synchronizing the sweep frequency, and to vary the average intensity of the vertical deflection signals on the scope, respectively.

1-13. The interior of the indicator unit primarily consists of a sweep frequency generator strip, spectrum calibrator, two i-f amplifier strips (1 mc and 64 mc), low-voltage power supply sweep and video, and a high-voltage power supply. Two interior indicator lamps, placed on both sides of the scope screen, provide illumination for the markings on the reticule (the plexiglass assembly mounted in front of the KRT face). The intensity of the two indicator lamps is varied by rotating the "SCALE ILLUMINATION" control on the front panel of the indicator unit.



1. "INPUT-MCS" cable receptacles
2. "FREQUENCY IN MEGACYCLES" dial
3. "IF ATTENUATION - DB" knob
4. "TUNE" knob
5. "BAND SELECTOR" knob

Figure 1-4. R-F Tuner TN-188/UPM, Front Panel View

1-14. R-F TUNER TN-188/UPM.

1-15. Shown in figure 1-4 is a front panel view revealing the location of all operating controls on the r-f tuner unit, which constitutes the lower half of the analyzer unit. Table I, Operating Controls, describes the function and lists the type and designation of each control. The r-f tuner unit panel consists of a direct-reading illuminated dial, "FREQUENCY IN MEGACYCLES," which displays the frequency of the local oscillator located in the tuner unit. The frequency of the oscillator is adjusted by the "TUNE" control, and as the "TUNE" knob is varied the dial rotates to indicate the frequency to which the input is tuned. The band of frequencies to be read on the dial is selectable by use of a seven-position "BAND SELECTOR" switch which enables the entire range of frequencies from 10 to 16,000 mc to be tuned. Four input receptacles "INPUT MCS" are included on the panel for connecting the analyzer to the radar equipment to be tested. To check the specified range of frequencies desired (10-150, 150-350, 350-1000, or 1000-16,000 mc), the appropriate input receptacle must be used. In conjunction with this, the "BAND SELECTOR" knob must be placed on the corresponding frequency range labeled on the panel.

1-16. The interior of the r-f tuner unit primarily consists of three oscillators, oscillators 1 and 2, oscillator 3, and oscillator 4, along with the i-f amplifier strip (160 mc). Also included is a gear train assembly, which is connected to the "TUNE" control, the "FREQUENCY IN MEGACYCLES" dial, and to the three oscillator assemblies. Thus, during tuning operation, as the "TUNE" control is manipulated, the frequency dial rotates simultaneously with the variable elements in the local oscillators.

TABLE I. OPERATING CONTROLS

Control	Figure & Index No.	Type and Designation	Function
PULSE ANALYZER INDICATOR IP-130/UPM-17			
"POWER"	13, figure 1-3	Indicator, I1003	When lit, indicates that input power is being delivered to the analyzer from an external source of a-c supply.
	10, figure 1-3	Switch, S1003	When not in the "OFF" position, places the analyzer in operation by feeding the 115-volt, 60-cps input to the power supply circuitry. In this position, indicator I1003 is lit.
"METER SELECTOR"	14, figure 1-3	Switch, S1002	In the "+150 V" position, enables positive supply potential to be read on the voltmeter indicator. In the "-150 V" position, enables negative supply potential to be read. In the "LINE VOLTS" position, enables input voltage (line voltage) to the analyzer to be read.
"SCALE ILLUMINATION"	16, figure 1-3	Switch S1001 Potentiometer R1003	An on-off switch arrangement with variable resistance control for turning on the scope indicator lamps behind the panel, which are used for illuminating the reticule and the scope screen. The control is used to vary the intensity of the scope indicator lamps.
"INTENSIFIER"	18, figure 1-3	Potentiometer, R1341	Varies the intensity of only the vertical deflection signals seen on the scope screen.
"SYNC"	19, figure 1-3	Potentiometer, R1301	Synchronizes the sweep frequency to a submultiple of the line frequency. Synchronization increases in CW direction.
"HORIZ CENTERING"	1, figure 1-3	Potentiometer, R1323	Directs the wave shape in the horizontal direction or X axis on the scope screen. Used to horizontally center the image viewed on the scope.

TABLE I. OPERATING CONTROLS (Cont)

Control	Figure & Index No.	Type and Designation	Function
PULSE ANALYZER INDICATOR IP-130/UPM-17 (Cont)			
"VERT CENTERING	2, figure 1-3	Potentiometer, R1336	Directs the wave shape in the vertical direction or Y axis on the scope screen. Used to vertically position the image viewed on the scope.
"HORIZ GAIN"	23, figure 1-3	Potentiometer, R1317	Narrows or broadens the baseline and image or wave shape viewed on the scope screen to the width of the reticule.
"VERT GAIN"	22, figure 1-3	Potentiometer, R1325	Increases or decreases the amplitude of the image viewed on the scope screen. (Do not operate below 1-1/2 divisions to avoid saturation of square law detector.)
"SWEEP FREQ"	21, figure 1-3	Potentiometer, R1307B	Controls the frequency of the sweep as displayed on the scope.
"SPECTRUM WIDTH"	20, figure 1-3	Potentiometer, R1314	Calibrates the entire width of the reticule (10 cm. wide) on the scope screen to represent a bandwidth of 1/2 to 25 mc. When analyzing frequencies below 50 mc, and the "BAND SELECTOR" switch is on "NARROW," this control should be limited to a value below the frequency being analyzed.
"SPECTRUM CALIBRATOR"			Presents a pip which acts as a marker on the scope screen. The pip is adjustable in amplitude and frequency. The pip allows frequency measurements of the 160 mc i-f to be made with ease.
"AMPLITUDE"	4, figure 1-3	Potentiometer, R1014	Varies the amplitude of the marker pip and shuts it off.
"FREQUENCY"	5, figure 1-3	Variable Capacitor, C1403	Varies the frequency (and, therefore, position) of the pip.
"FOCUS"	6, figure 1-3	Potentiometer, R1006	Controls the sharpness or distinction of the image displayed on the scope screen for viewing purposes.
"BRIGHTNESS"	7, figure 1-3	Potentiometer, R1004	Used to vary the brightness of the pulse or any deflection pattern seen on the scope.
"SPECTRUM CENTERING"			Changes the frequency spectrum electronically to center of the reticule.
"COARSE"	8, figure 1-3	Potentiometer, R1017	Varies the spectrum frequency in a coarse manner.
"FINE"	9, figure 1-3	Potentiometer, R1018	Varies the spectrum frequency in a fine manner.
"3 AMP"	11, 12, figure 1-3	Fuses, F1001, F1002	Protects the analyzer instrument against overload.
"SPARES"	17, figure 1-3	Spare Fuses F1001, F1002	Spare fuses to be used if the "3 AMP" fuses become defective.

TABLE I. OPERATING CONTROLS (Cont)

Control	Figure & Index No.	Type and Designation	Function
		R-F TUNER UNIT TN-188/UPM	
"FREQUENCY IN MEGA-CYCLES"	2, figure 1-4	Dial mechanically connected to the shaft of the "TUNE" control	Indicates frequency of signal to which analyzer is tuned. Dial rotates as "TUNE" control is varied clockwise or counter-clockwise.
"TUNE"	4, figure 1-4	Knob connected by gearing to variable capacitors C2502 and C2515 in local oscillator	Used to adjust the frequency of the signal to which analyzer is tuned. By rotating the "TUNE" control capacitors, C2502 and C2515 vary to change the oscillator frequency.
"BAND SELECTOR"	5, figure 1-4	Selector Switch, S2001	Used to select the frequency band desired for analyzing.
"INPUT MCS"	1, figure 1-4	Receptacles	Signal input receptacles used for connecting the analyzer instrument to the equipment to be tested.
"10-150"		J2004	Input receptacle used for analyzing frequencies between 10 and 150 mc.
"150-350"		J2005	Input receptacle used for analyzing frequencies between 150 and 350 mc.
"350-1000"		J2006	Input receptacle used for analyzing frequencies between 350 and 1000 mc.
"1000-16,000"		J2007	Input receptacle used for analyzing frequencies between 1000 and 16,000 mc.
'IF ATTENUATION DB"	3, figure 1-4	Selector Switch S2002	Controls attenuation of output of 160 mc i-f amplifier.

1-17. VARIABLE R-F ATTENUATORS. Two variable r-f attenuators are supplied and used: the Variable R-F Attenuator CN-319/UPM-17 and the Variable R-F Attenuator CN-211/U (see figure 1-5). The former covers a frequency range of 1 to 4 kilomegacycles, while the latter covers a range from 4 to 12.4 kilomegacycles. Both attenuators are of the waveguide-below-cutoff type and operate in the $TE_{1,1}$ mode (inductive coupling). The R-F Attenuator CN-319/UPM-17 contains a 50-Ohm termination. The output impedance of the attenuator is varied by rotating the calibrated micrometer adjustment. Each revolution of the micrometer barrel changes the attenuation 20 db, the range of the readings being from -9 db to 140 db. The R-F Attenuator CN-211/U micrometer adjustment contains two major divisions marked 50 and 100, and 25 sub-divisions, each corresponding to a change of five points on the scale. Each revolution of the micrometer barrel changes the scale setting by one sub-division, corresponding to an attenuation of approximately 11 db (at 9430 mc).

1-18. SUPPLEMENTARY DATA.

1-19. Supplementary data on the Spectrum Analyzer AN/UPM-17 is given in Tables II, III, IV, V and VI. Table II, Equipment Limitations, lists the operating characteristics of the test instrument. Table III, Equipment Supplied, lists thecomponents supplied to the operating activity as part of the analyzer equipment. Table IV, Equipment Required But Not Supplied, lists the components not supplied but which are required by the operating activity to operate the analyzer. Each tabulated item indicates the quantity required for a typical installation, the short form name, and Government type designation. Table V, Tube Complement, lists all the tubes and crystals used, by component, along with the quantity, JAN type number and functions of each. Table VI, Fuse Complement, lists all the fuses used, by component, along with the quantity, type number and ampere rating of each.

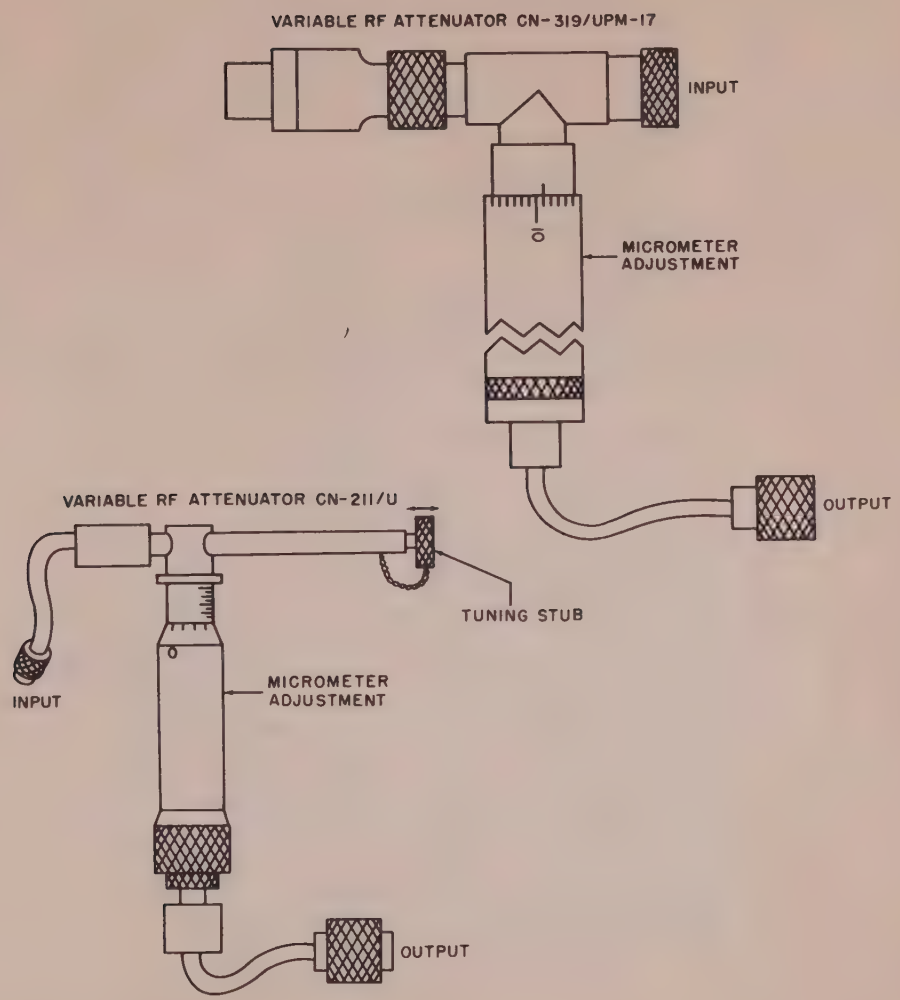


Figure 1-5. Variable R-F Attenuators

TABLE II. EQUIPMENT LIMITATIONS

Power Requirements	Frequency Range	Sensitivity (1 inch deflection, 1 mc spectrum width)		Stability	Spectrum Width	Resolution	Temperature Range
		Range (mc)	Sensitivity (dbm)				
115 volts, 60 cps, 250 watts, max.	10 to 16,000 mc	10-100	-63	0.5% under all operating conditions	1 to 25 mc	10 kc	OPERATING 0°C to 55°C (32°F to 131°F)
		100-350	-67				
		350-1000	-52				
		1000-16,000	-50				NON OPERATING -40°C to 71°C (-40°F to 160°F)
		1000-16,000	-40 (25 mc spectrum width)				

TABLE III. EQUIPMENT SUPPLIED

Quantity Per Equipment	Name of Unit	Government Type Designation
1	Pulse Analyzer Indicator	IP-130/UPM-17
1	R-F Tuner	TN-188/UPM
1	Variable R-F Attenuator	CN-319/U
1	Variable R-F Attenuator	CN-211/U
1	Case	CY-903/UPM-17
1	Cord - 10 feet	CX-1059/U
1	Cord - 6 feet	CG-92E/U
1	Special Purpose Cable Assembly	CX-3162/U
1	Special Purpose Cable Assembly	CX-3163/U

TABLE IV. EQUIPMENT REQUIRED BUT NOT SUPPLIED

No equipment is required other than that supplied.

TABLE V. TUBE COMPLEMENT

Component	Tube		Function	Quantity
	JAN No.	Reference Symbol		
1 MC I-F Amplifier	6AU6WA	V1205	Square Law Detector	2
		V1206	Square Law Detector	
	5725/ 6ASGW	V1202	Mixer	1
	1/212AT7WA	V1201	Oscillator	
	1/212AT7WA		Frequency Doubler	2
	12AT7WA	V1204	Phase Inverter	
	6186/ 6AG5WA	V1203	Amplifier	1
64 MC I-F Amplifier	6AN4	V1101	Mixer	1
	5654/ 6AK5WA	V1102	I-F Amplifier	
		V1103	I-F Amplifier	4
		V1104	I-F Amplifier	
		V1105	I-F Amplifier	
160 MC I-F Amplifier	5654/ 6AK5WA	V2201	I-F Amplifier (Wideband)	
		V2202	I-F Amplifier (Wideband)	
		V2203	I-F Amplifier (Wideband)	
		V2204	I-F Amplifier (Wideband)	10
		V2205	I-F Amplifier (Wideband)	
		V2206	I-F Amplifier (Wideband)	
		V2207	I-F Amplifier (Wideband)	
		V2208	I-F Amplifier (Narrowband)	
		V2209	I-F Amplifier (Narrowband)	
		V2210	I-F Amplifier (Narrowband)	
Sweep Frequency Generator	5654/ 6AK5W	V1501	Reactance Modulator	
		V1505	Frequency Tripler	3
		V1506	Frequency Doubler	
	6AH6	V1503	R-F Amplifier	
		V1504	R-F Amplifier	5

TABLE V. TUBE COMPLEMENT (Cont)

Component	Tube		Function	Quantity
	JAN No.	Reference Symbol		
Sweep Frequency Generator (Cont)	12AT7WA	V1502	Frequency Modulated Oscillator	1
Oscillator 1 and 2	6AN4	V2504	Mixer	2
		V2502	Mixer	
	12AT7WA	V2503	Oscillator	1
	6AF4	V2501	Oscillator	1
Oscillator 3	5675	V2701	Oscillator	1
Oscillator 4		Z2702	Mixer (Crystal)	1
	2C36	V2901	Oscillator	1
Power Supply and Video		Z2902	Mixer (Crystal)	1
	12AU7	V1301	Multivibrator	
	1/212AU7	V1302	Sweep Generator	
	1/212AU7		FM Sweep Amplifier	4
	12AU7	V1305	Video Amplifier	
	1/212AU7		D. C. Restorer	
	1/212AU7	V1307	Intensifier Amplifier	
	12AT7WA	V1304	Video Amplifier	1
	6AU6WA	V1306	Intensifier Squaring	1
	6080	V1311	Series Regulator	2
			Series Regulator	
	OB2WA	V1310	Voltage Regulator	1
	12AX7	V1303	Sweep Amplifier	3
		V1309	Amplifier	
		V1312	Amplifier	
Spectrum Calibrator	12AT7WA	V1401	Oscillator	1
Pulse Analyzer Indicator IP-130/UPM-17	5CP1A	V1001	Cathode-Ray Tube (Display)	1

TABLE VI. FUSE COMPLEMENT

Component	Fuse	Rating (amps)	Type No.
Pulse Analyzer Indicator IP-130/UPM-17	F1001	3	3A-G
	F1002	3	3A-G
Power Supply	F1301	1	3A-G
	F1302	.25	3A-G

SECTION II

TEST EQUIPMENT AND SPECIAL TOOLS

2-1. TEST EQUIPMENT. The test equipment listed in table VII is required for overhaul of the Spectrum Analyzer AN/URM-17 and is not listed in the Handbook of Service Instructions. The first column identifies the illustration of each item of special test equipment only; the second column identifies the test equipment, the third column lists the applicable government or manufacturer's part number; and the fourth column lists the uses of the test equipment by referring to the paragraph in which each is used.

2-2. SPECIAL TOOLS. No special tools are required for overhaul of the spectrum analyzer. Tools frequently used with the equipment are supplied and stored in the carrying case of the spectrum analyzer.

TABLE VII. TEST EQUIPMENT

Figure No.	Name *	AN Type or Mfg Designation **	Use
2-1	Detector Test Jig	*	Paragraphs 3-20, 3-32, 3-36 and 3-49.
2-2	B+ Switching Jig	*	Paragraphs 3-20, 3-32 and 3-36.
2-3	Sawtooth Generator Jig	*	Paragraph 3-49.
2-4	Power Supply Test Jig	*	Paragraph 3-52.
	Frequency Meter	FR-5 (AN/URM-80)	Paragraphs 3-41 and 3-45.
	Frequency Meter	FR-6 (AN/URM-81)	Paragraphs 3-11 and 3-60.
	Frequency Meter	FR-61	Paragraphs 3-11 and 3-28.
	Signal Generator	Hewlett Packard Model 608	Paragraphs 3-20, 3-32 and 3-36.
	Signal Generator	Measurements Corp Model 80	Paragraphs 3-41 and 3-45.
	Sweep Generator	Kay Megasweep Model 111A	Paragraphs 3-20, 3-32 and 3-36.
	Audio Oscillator	Hewlett Packard Model 200c	Paragraph 3-52
	Grid Dip Meter	Measurements Corp Model 59	Paragraph 3-49.
	Oscilloscope	DuMont Model 304	Paragraphs 3-20, 3-36, 3-49 and 3-52.
	Oscilloscope	Lavoie Model LA-239c (AN/USM-50A)	Paragraph 3-45.
	R-F Voltmeter	Measurements Corp Model 62	Paragraph 3-41.
	A-C VTVM	Ballantine Model 300	Paragraphs 3-52 and 3-64.
	Wide Band Electronic Voltmeter	Ballantine Model 314	Paragraphs 3-45 and 3-60.
	Multitester	Simpson Model 260	Paragraphs 3-11, 3-24 and 3-28.
	Multitester	Triplett Model 630	Paragraph 3-64.

* Test Jigs must be fabricated.
** Where commercial sources are cited, equivalents may be used.

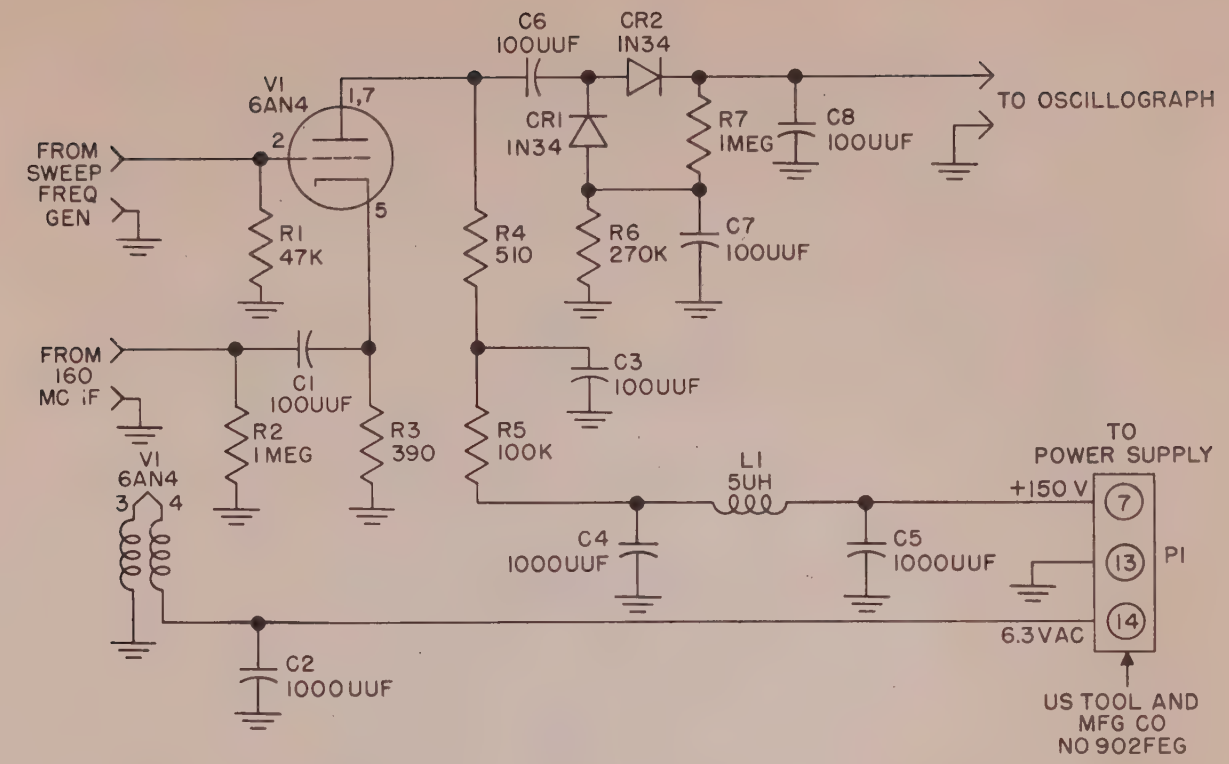


Figure 2-1. Detector Test Jig

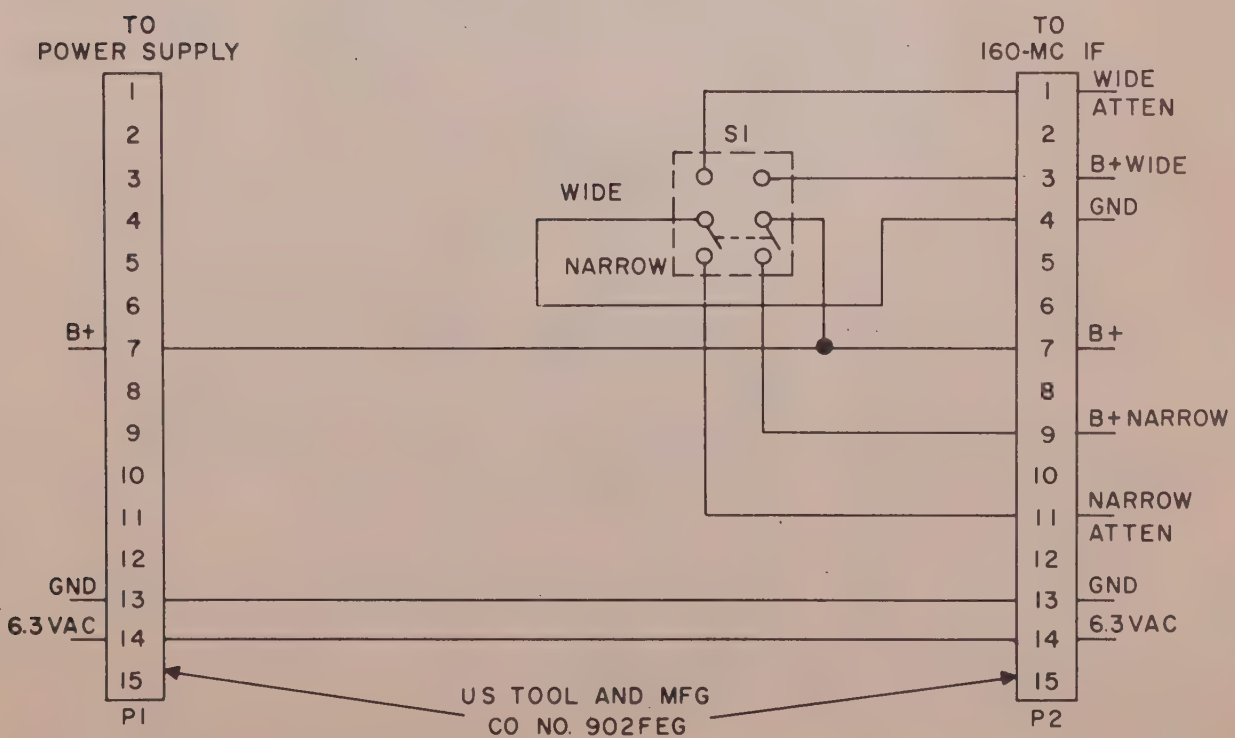


Figure 2-2. B+ Switching Jig

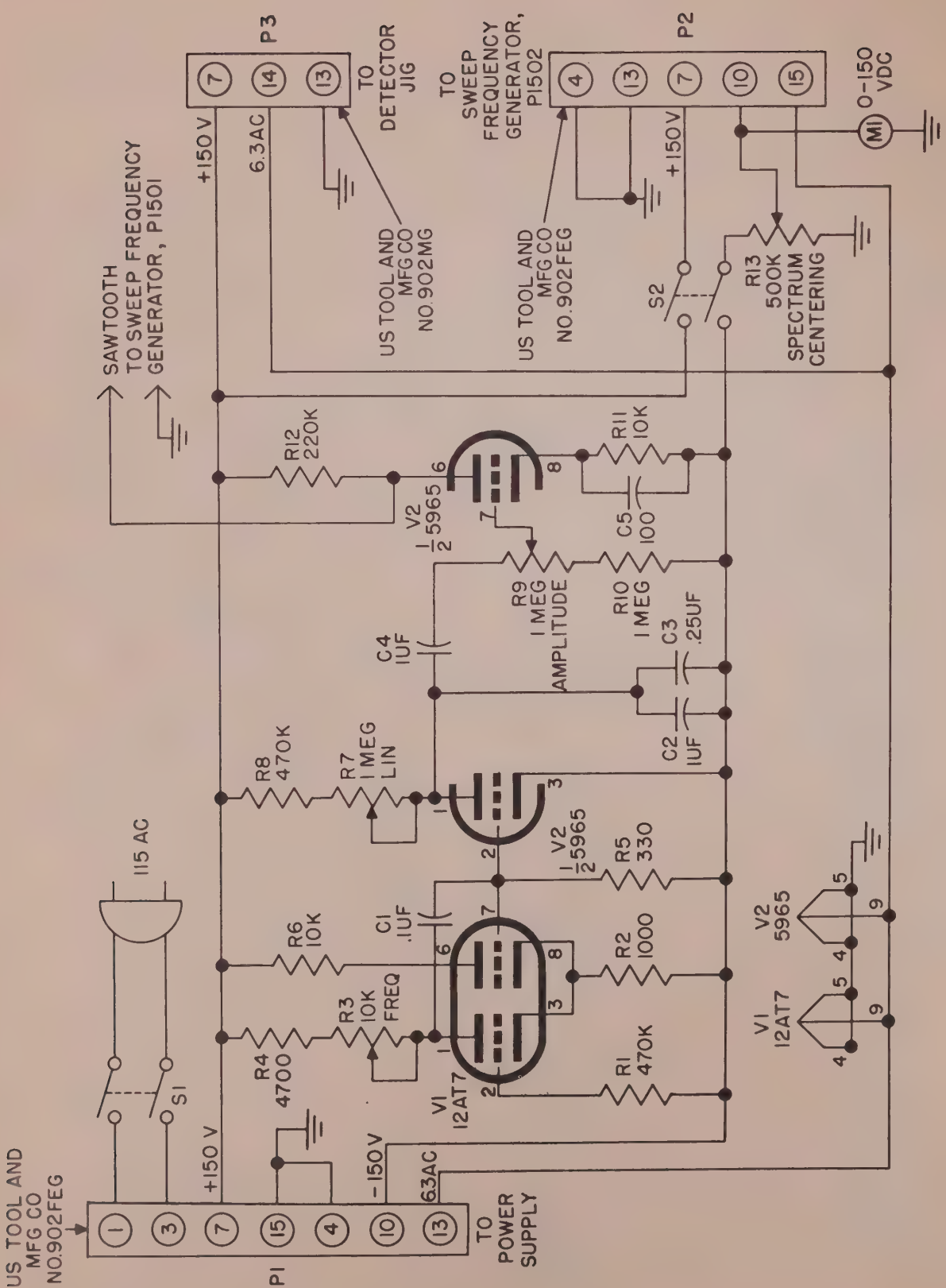


Figure 2-3. Sawtooth Generator Jig

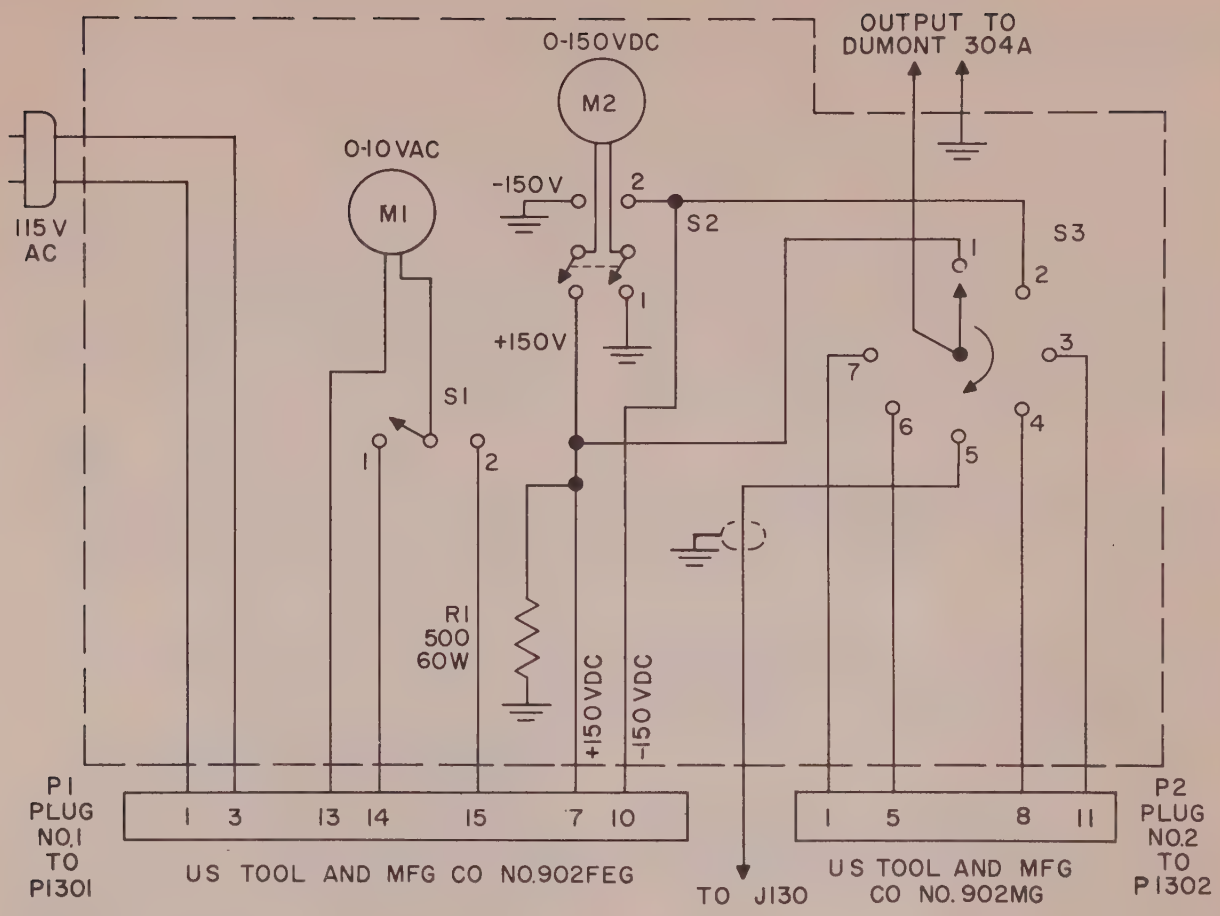


Figure 2-4. Power Supply Test Jig

SECTION III

MAINTENANCE BEYOND CAPABILITIES OF FIELD

3-1. GENERAL.

3-2. This section contains the test procedures and data necessary to determine, prior to disassembly, the extent of overhaul required. The instructions provided herein are at depot maintenance level and are beyond the capabilities of field facilities. However, additional instructions contained in the applicable Handbook of Service Instructions may be referred to as required.

3-3. INSPECTION. The methods and inspection standards of mechanical and electrical parts and assemblies described in paragraphs 6-1 through 6-27 should be used in visually determining the overhaul requirements.

3-4. TROUBLE ANALYSIS. The trouble analysis charts and schematics keyed with the chart's reference test points are contained in the Handbook of Service Instructions. They will aid in the determination of troubles that cannot be localized by test procedures alone.

3-5. VOLTAGE AND RESISTANCE CHARTS. The voltage and resistance charts contained in the applicable Handbook of Service Instructions list the values to be used in performing voltage continuity and resistance checks.

3-6. ELECTRON TUBE TESTING. Verify the conditions of electron tubes by testing them in a mutual conductance tube tester. Replace a defective tube with a new tube of the same type.

NOTE

Remove tubes from the unit one by one and make certain each good tube is returned to the socket from which it was removed.

3-7. BENCH TEST PROCEDURES.

3-8. GENERAL. The procedures for bench testing the individual subassemblies comprising Spectrum Analyzer AN/UPM-17 are contained in the following paragraphs. These procedures are arranged in two groups, the R-F Tuner TN-188/UPM and the Pulse Analyzer Indicator IP-130/UPM-17.

NOTE

Control markings which appear in quotation marks are those of the spectrum analyzer. Names of controls beginning with initial capitals appear on the test equipment in the particular test procedure.

3-9. TEST EQUIPMENT. The test equipment required is listed in table VII. In addition, the necessary test equipment required for each individual test is listed in the particular test procedure. Some procedures also require the use of units of the spectrum analyzer which are known to meet new equipment standards of operation. Where required, they are listed with the other test equipment called for in a procedure.

NOTE

Equivalent test equipment may be used in lieu of the specified test equipment.

3-10. R-F TUNER TN-188/UPM.

3-11. TEST OF R-F TUNER DRAWER. For test setup see figure 3-1.

3-12. TEST EQUIPMENT REQUIRED.
a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Regulated Power Supply UPM-17
d. Frequency Meter FR-61
e. Frequency Meter FR-6
f. Milliammeter 0-100 ma, Simpson Model 260.

3-13. PRELIMINARY PROCEDURE. Connect the test equipment to the R-F Tuner Drawer as shown in figure 3-1 and proceed as follows:
a. Decouple the oscillator 3 gear, the dial gear, stops, and the bellows connection to oscillator 1 and 2.
b. Check to see that the grey leads on oscillator 3 and oscillator 4, and the black lead on oscillator 4 are connected to ground and the brown leads are connected to the standoffs.
c. Check to see that the B+ lead (with 1K ohm 5 watt resistor) located under oscillator 1 and 2 goes to oscillator 4.
d. Check to see that all antibacklash gears are loaded approximately 1-1/2 teeth.
e. Tighten all setscrews on the gears that are not decoupled. Check all screws, nuts and connections.

3-14. TEST PROCEDURE.

3-15. Turn the equipment on and perform the following oscillator frequency checks.

3-16. OSCILLATOR 4.
a. Set the "BAND SELECTOR" switch to the "1-2 KMCS" (oscillator 4) position and check the milliammeter for a reading of not more than 40 ma.

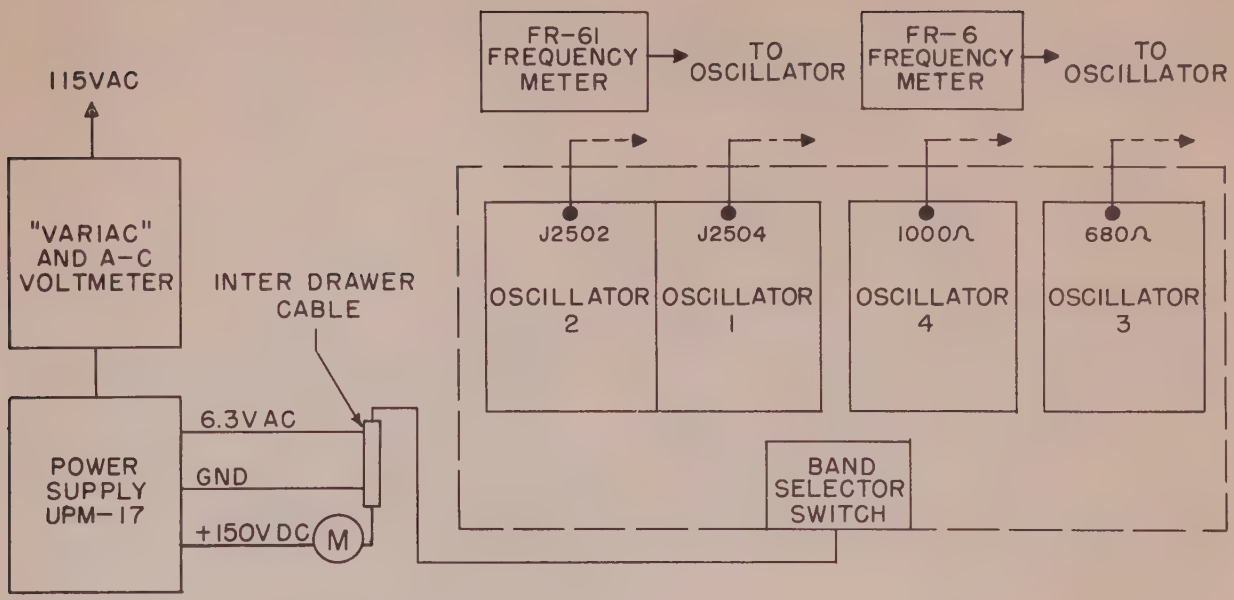


Figure 3-1. R-F Tuner Drawer Test Setup

CAUTION

If the meter reading reaches 100 ma and remains, turn off the equipment immediately and check for a B+ short.

b. Set the controls on the FR-61 to the Coarse and Modulation On positions at 1840 mc. Couple the high input jack of the FR-61 to oscillator 4 using loose coupling.
c. Tune oscillator 4 to the FR-61 signal.
d. Set the FR-61 to the Measure and Modulation Off position and zero beat by varying the Fine Tune control.

NOTE

The signal should be strong and clear on both sides of the zero beat.

e. Tuning the oscillator slowly, bring the zero beat in at the 10.8235 setting on the FR-61 using the 85th harmonic.
f. Set the dial to "2000" mc and lock the dial gear.

NOTE

This oscillator operates 160 mc below the dial setting.

g. Set the dial to "1500" mc. Set the FR-61 to the Coarse and Modulation On positions.
h. Find the signal by tuning the FR-61 to approximately 1340 mc.
i. Set the FR-61 to the Measure and Modulation Off positions and zero beat by varying the Fine Tune control.
j. The reading on the FR-61 must be 1340 ±13.4 mc.
k. Set the dial to "1000" mc. Set the FR-61 to the Coarse and Modulation On positions.
l. Find the signal by tuning the FR-61 to approximately 840 mc.
m. Set the FR-61 to the Measure and Modulation Off positions and zero beat by varying the Fine Tune control.
n. The reading on the FR-61 must be 840 ±8.4 mc.
o. Set the dial back to "2000" mc. Set the FR-61 to the Coarse and Modulation On positions.
p. Find the signal by tuning the FR-61 to approximately 1840 mc.
q. Set the FR-61 to the Measure and Modulation Off positions and zero beat by varying the Fine Tune control.
r. The reading on the FR-61 must be 1840 ±18.4 mc.
s. Set the dial to the end of its range with the marker on the line. Set the stops using the flat surfaces on the shafts for setscrews. Check the stops on both ends.
t. Track the signal throughout the oscillator's range, with the FR-61, checking for cutout points and checking the dial settings listed in table VIII.

3-17. OSCILLATOR 3.

a. Set the "BAND SELECTOR" switch to the "350-1000 MCS" (oscillator 3) position.
b. Set the controls on the FR-61 to the Coarse and Modulation On positions at 1160 mc. Couple the high input jack of the FR-61 to oscillator 4 using

TABLE VIII. OSCILLATOR 4 DIAL SETTING CHECKS

Dial Setting (MC)	Frequency (MC)	Tolerance (MC)
"2100"	1940	±19.4
"1800"	1640	±16.4
"1500"	1340	±13.4
"1200"	1040	±10.4
"950"	790	±7.9

loose coupling.

c. Tune oscillator 3 to the FR-61 signal.

d. Set the FR-61 to the Measure and Modulation Off positions and zero beat by varying the Fine Tune control.

e. Tuning the oscillator slowly, bring the zero beat in at the 10.7407 setting on the FR-61 using the 54th harmonic.

f. Set the dial to "1000" mc.

NOTE

This oscillator operates 160 mc above the dial setting.

g. Lock the gear drive on the flat setting, loading the backlash gear to 1-1/2 teeth. Make sure the dial setting remains at "1000" mc while engaging the gears with the oscillator.

h. Set the dial to "700" mc. Set the FR-61 to the Coarse and Modulation On positions.

i. Find the signal by tuning the FR-61 to approximately 860 mc.

j. Set the FR-61 to the Measure and Modulation Off positions and zero beat by varying the Fine Tune control.

k. The reading on the FR-61 must be 860 ±8.6 mc.

l. Using the FR-61, track the signal throughout its range using steps h through k and the values given in table IX. Also check for cutout points.

m. If necessary use the feedback screw to balance out the settings, and then tighten the lock nut.

3-18. OSCILLATOR 1.

a. Set the "BAND SELECTOR" switch to the "10-150 MCS WIDE" (oscillator 1) position.

b. Loosen the bellows connection on the gear drive shaft. Set the variable capacitors of both oscillator 1 and oscillator 2 to the fully meshed position by turning the bellows connection. Set the dial to "0" mc and then lock the bellows to the gear drive shaft.

c. Set the dial to "10" mc. Set the FR-6 controls to coarse at 170 mc, and zero beat against the oscillator signal.

d. Set the FR-6 to Fine and zero beat by varying the Fine control.

e. Set the FR-6 to 4,250,000 on the 40th harmonic and adjust trimmer C2518 (with special bakelite tool supplied), located on the left side of oscillator 1, for a zero beat.

f. Set the FR-6 to the check position and calibrate the Check Point nearest the reading obtained.

g. Set the FR-6 to the Fine position and check that the oscillator frequency is 170 ±1.7 mc.

h. Set the dial to "160" mc. Set the FR-6 controls to coarse at 320 mc and zero beat against the oscillator signal.

i. Set the FR-6 to 4,324,000 on the 74th harmonic and adjust the oscillator loop coil for a zero beat.

NOTE

To increase the frequency press the coil slightly. To decrease the frequency raise the coil slightly.

CAUTION

Use extreme care when adjusting the loop coil. The connecting leads are short and can be damaged easily.

TABLE IX. OSCILLATOR 3 DIAL SETTING CHECKS

Dial Setting (MC)	Frequency (MC)	Tolerance (MC)
"350"	510	±5.1
"500"	660	±6.6
"650"	810	±8.1
"1000"	1160	±11.6

j. Set the FR-6 to the Check position and calibrate the Check Point nearest the reading obtained.
k. Set the FR-6 to the Fine position and check that the oscillator frequency is 320 ±3.2 mc.
l. Repeat steps c through k until both the high and low ends require no adjustment and are within tolerance.

NOTE

All oscillator frequency checks must be made with the oscillator cover on.

m. Using the FR-6, track the oscillator signal throughout its range using steps c through k and the values given in table X. Also check for cutout points.

TABLE X. OSCILLATOR 1 DIAL SETTING CHECKS

Dial Setting (MC)	Frequency (MC)	Tolerance (MC)
"10"	170	±1.7
"80"	240	±2.4
"150"	310	±3.1

3-19. OSCILLATOR 2.
a. Set the "BAND SELECTOR" switch to the "150-350 MCS" (oscillator 2) position.
b. Using the procedure outlined in steps 3-18c through 3-18k calibrate oscillator 2 by performing the following: adjust the trimmer C2504 on the rear-right side of the oscillator for 300 ±3 mc at dial setting "140" mc; adjust the bars inside the oscillator for 520 ±5.2 mc at dial setting "360" mc.

NOTE

To increase the frequency squeeze bars closer.
To decrease the frequency spread bars apart.

c. Using the FR-6, track the oscillator signal throughout its range using the procedure outlined in steps 3-18c through 3-18k and the values given in table XI. Also check for cutout points.

TABLE XI. OSCILLATOR 2 DIAL SETTING CHECKS

Dial Setting (MC)	Frequency (MC)	Tolerance (MC)
"150"	310	±3.1
"250"	410	±4.1
"350"	510	±5.1

3-20. TEST OF OSCILLATOR 1 AND 2 STRIP.

3-21. TEST EQUIPMENT REQUIRED.
a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Regulated Power Supply UPM-17
d. 160-MC I-F Strip UPM-17
e. Hewlett Packard Model 608 Signal Generator
f. Kay Megasweep Model 111A Sweep Generator
g. DuMont Oscilloscope Model 304
h. Detector Jig 07000
i. B+ Switching Jig 07401

3-22. PRELIMINARY PROCEDURE.
a. Set up the sweep generator according to the applicable instruction manual.
b. Connect the High Out jack of the sweep generator to the detector. Connect the Output side of the detector to the Vertical Input on the oscilloscope.
c. Set the sweep generator for a flat response by setting it in the mode that will give the best presentation on the oscilloscope.
d. Set the model 608 signal generator to 160 mc and adjust the Attenuator so that the marker is visible on the oscilloscope.
e. Vary the signal generator Frequency dial from 145 mc to 175 mc and adjust the sweep generator so that the 145 mc marker is at the low end of the scope presentation and the 175 mc marker is at the high end of the scope presentation. Disconnect the test equipment.
f. Connect the test equipment to oscillator 1 and 2 as shown in figure 3-2.
g. Set both capacitor plates to the fully-meshed position.
h. Check that the antibacklash gears are loaded one booth and mesh in the center of the worm.
i. Check for easy rotation and quietness of gears.

3-23. TEST PROCEDURE.
a. Turn on the equipment and set the capacitors to the half-meshed position.

NOTE

Pull out the tubes of the oscillator not being checked.

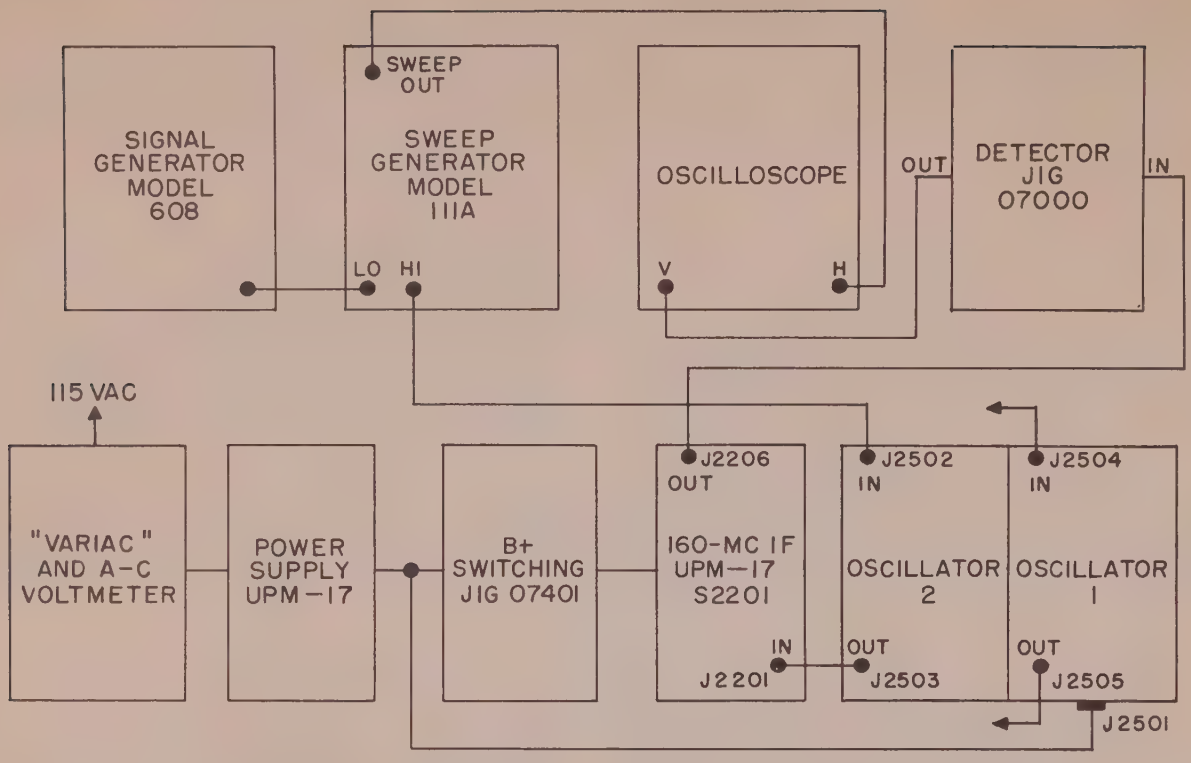


Figure 3-2. Oscillator 1 and 2 Test Setup

b. Rotate switch S2201 on the 160-MC I-F assembly fully clockwise, and then back off one position.
c. Set the B+ switching jig to the Wide position.
d. Set the Signal Generator Model 608 to 160 mc and vary the Attenuator until a marker is visible on the scope presentation.
e. Vary the Model 608 from 147.5 mc to 172.3 mc and adjust L2503 and L2505 for a bandwidth of of 25 mc as shown in figure 3-3.

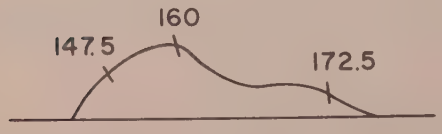


Figure 3-3. Oscillator 1 and 2 Bandwidth

f. Disconnect the cables from oscillator 2 and connect them to oscillator 1 as follows: from J2502 to J2504, from J2503 to J2505.
g. Repeat steps d and e using coils L2513 and L2514 for the bandwidth adjustment on oscillator 1.

3-24. TEST OF OSCILLATOR 3.

3-25. TEST EQUIPMENT REQUIRED.
a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/SPM-3
c. Regulated Power Supply UPM-17
d. Frequency Meter FR-61
e. Milliammeter 0-100 ma, Simpson Model 260
f. 680-ohm, 2-watt resistor.

3-26. PRELIMINARY PROCEDURE.
a. Remove the mixer unit that is screwed into the top rear of the cavity and check the probe for tightness and the cuptal connections for good contact.

CAUTION

The mixer unit must not be screwed in more than three turns in order to prevent it from shorting.

b. Check that the threads of the calibrating screw located on the left rear of the cavity, protrude about 1/8 of an inch from the nut. The nut should be hand tightened so that it may be adjusted during the final calibration.
c. Check that the large white rods are connected to the plate cylinder and the small offset rods are

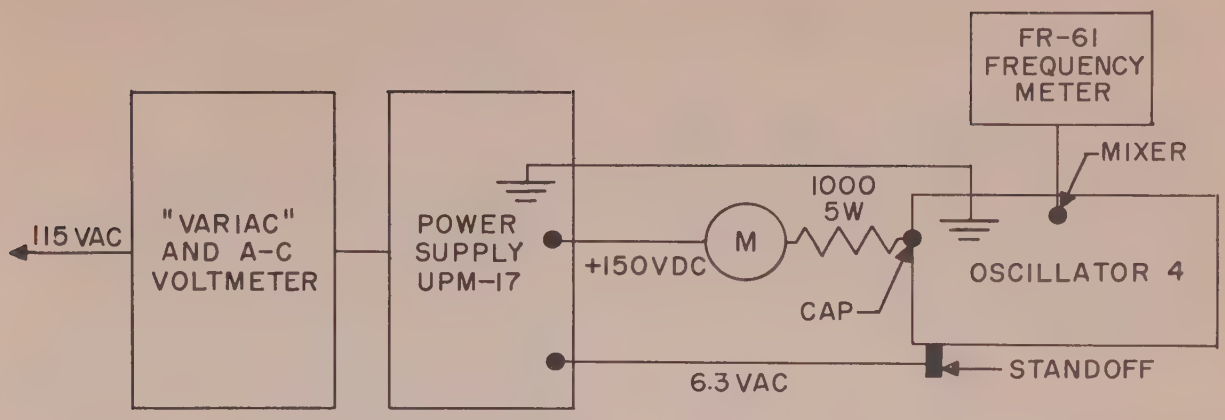


Figure 3-4. Oscillator 3 Test Setup

connected to the cathode cylinder.

d. Connect the test equipment to the oscillator as shown in figure 3-4.

NOTE

Use loose coupling between the FR-61 and the oscillator.

3-27. TEST PROCEDURE.

a. Turn on the power and set the "VARIAC" to 115 volts ac, and then check the 6.3 volts ac and the +150 volts dc from the power supply.

b. With the two sets of rods equally extended, move them and check for an indication on the milliammeter. If there is no indication, turn the calibrating screw out slightly and then back in. If this fails to produce an indication, turn the equipment off and check all connections. Remove the back plate cover and check for solder or pieces of metal on the plate. Remove the electron tube V2701 carefully and check that the contact spring for the grid cylinder is in a position to make good contact with the grid of the tube V2701. Check the heater leads on the tube. Replace the tube V2701 using the tool provided. Put the teflon sleeve on the tube and the teflon washer in the flange of the cavity. Replace the plate cover properly with the tube in the center. Replace the screws firmly but not too tight. Make all the connections and turn the power on. Move the rods or the calibrating screw and check for an indication on the milliammeter. If an indication appears, proceed with the following steps.

CAUTION

Do not apply excessive pressure to the rods.

NOTE

The meter reading must not exceed 40 ma.

c. Move the rods in to the furthest point of insertion.

d. Check the oscillator frequency with the FR-61 set to about 1160 mc. If the signal cannot be found, move the rods out slightly to find the signal.

e. Move the calibration screw slowly and set it for the lowest dip on the milliammeter. Hold the screw in place and tighten the lock nut.

NOTE

For optimum calibration response the frequency of the oscillator, with the rods at the furthest point of insertion, must be 1200 mc or higher. If necessary the calibration screw may be readjusted.

f. Move the rods out together and slowly, and track the signal with the FR-61. The oscillator unit must oscillate down to 500 mc or less.

g. If the unit fails to operate properly or does not oscillate throughout the entire range, check oscillator 3 using the procedure outlined in step b.

h. Set the "VARIAC" to 103 volts and check that the oscillator operates normally over the entire range.

3-28. TEST OF OSCILLATOR 4.

3-29. TEST EQUIPMENT REQUIRED.

a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/SPM-3
c. Regulated Power Supply UPM-17
d. Frequency Meter FR-61
e. Milliammeter 0-100 ma, Simpson Model 260
f. 1000-ohm, 2-watt resistor.

3-30. PRELIMINARY PROCEDURE.

a. Remove the mixer unit that is screwed into the top rear of the cavity and check the probe for tightness and the crystal connections for good contact.

CAUTION

The mixer unit must not be screwed in more than three turns in order to prevent it from shorting.

b. Check that the threads of the calibrating screw, located on the right-rear of the cavity, protrude about 1/4 of an inch from the nut. The nut should be hand tightened so that it may be adjusted during the final calibration.
c. Check that the large white rods are connected to the plate cylinder and the small offset rods are connected to the cathode cylinder.
d. Connect the test equipment to the oscillator as shown in figure 3-5.

NOTE

Use loose coupling between the FR-61 and the oscillator.

3-31. TEST PROCEDURE.
a. Turn on the power and set the "VARIAC" to 115 volts ac, and then check the 6.3 volts ac and the +150 volts dc from the power supply.
b. With the two sets of rods equally extended, move them and check for an indication on the milliammeter. If there is no indication, check the oscillator unit using the procedure outlined in step 3-27b.

CAUTION

Do not apply excessive pressure to the rods.

NOTE

The meter reading should not exceed 40 ma.

c. Move the rods in to the furthest point of insertion.
d. Check the oscillator frequency with the FR-61 set to about 2000 mc. If the signal cannot be found move the rods out slightly to find the signal.
e. Move the calibration screw slowly and set it for the lowest dip on the milliammeter. Hold the screw in place and tighten the lock nut.

NOTE

For optimum calibration response the frequency of the oscillator, with the rods at the furthest point of insertion, must be 2000 mc or higher.

f. Move the rods out together and slowly, and track the signal with the FR-61. The oscillator unit must oscillate down to 750 mc.
g. If the unit fails to operate properly or does not oscillate throughout the entire range check oscillator 4 using the procedure outlined in step 3-27b.
h. Set the "VARIAC" to 103 volts and check that the oscillator operates normally over the entire range.

3-32. TEST OF 160-MC I-F STRIP.

3-33. TEST EQUIPMENT REQUIRED.
a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Regulated Power Supply UPM-17
d. Hewlett Packard Model 608 Signal Generator
e. Kay Megasweep Model 111A Sweep Generator
f. DuMont Oscilloscope Model 304
g. Detector 0700
h. B+ Switching Jig 07401.

3-34. PRELIMINARY PROCEDURE.
a. Turn on the power in the test equipment and allow a 15 minute warmup period.
b. Set up the sweep generator according to the applicable instruction manual.
c. Connect the High Out jack of the sweep generator to the Input side of the detector. Connect the Out-

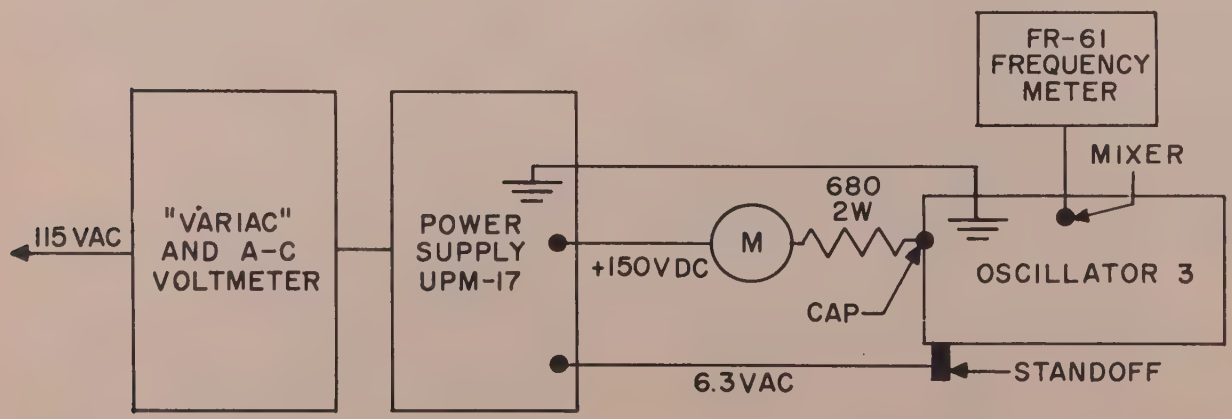


Figure 3-5. Oscillator 4 Test Setup

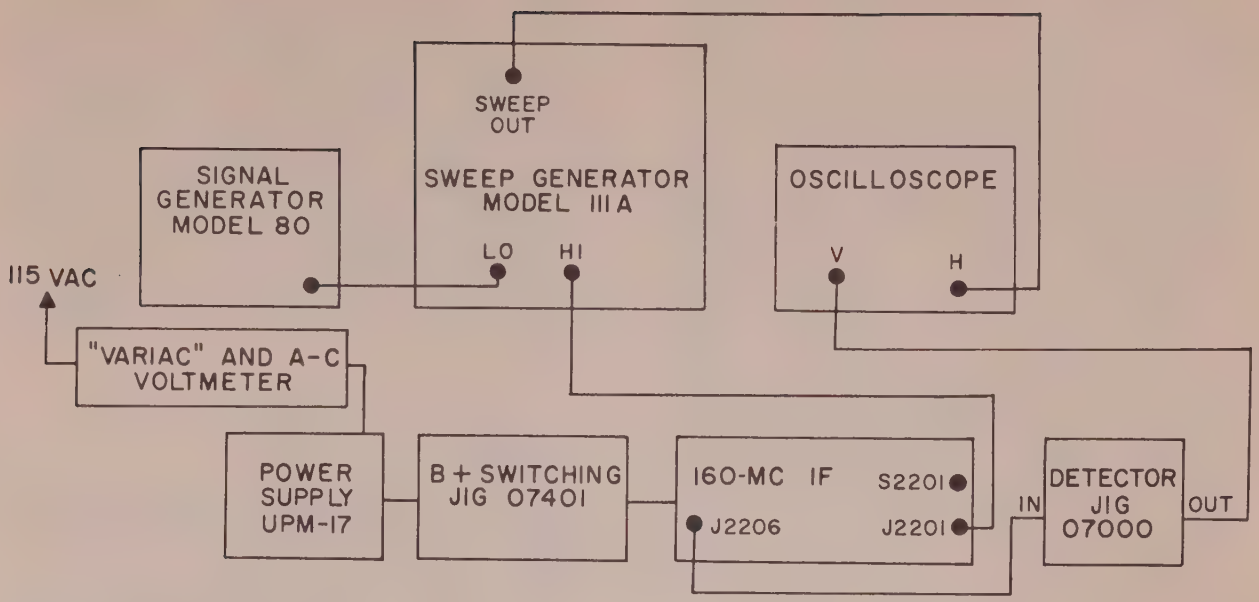


Figure 3-6. 160-MC, I-F Strip Test Setup

put side of the detector to the Vertical Input on the oscilloscope.

d. Set the sweep generator for a flat response by setting it in the mode that will give the best presentation on the oscilloscope.

e. Set the Model 608 signal generator to 160 mc and adjust the Attenuator so that the marker is visible on the oscilloscope.

f. Vary the signal generator frequency dial from 145 mc to 175 mc and adjust the sweep generator so that the 145 mc marker is at the low end of the scope presentation and the 175 mc marker is at the high end of the scope presentation. Disconnect the test equipment.

g. Connect the test equipment to the 160 mc, I-F strip as shown in figure 3-6.

3-35. TEST PROCEDURE.

a. Turn the Attenuator on the sweep generator fully clockwise. Set the switch on the B+ jig to the wide positions.

b. Turn switch S2201 on the I-F strip fully clockwise and then back off one position (wide position).

c. Turn on the power.

d. Set the signal generator to 160 mc and turn up the Attenuator until the 160 mc marker is visible on the oscilloscope presentation.

e. Adjust coils L2204 and L2216 for maximum amplitude of 160 mc marker.

f. Set the signal generator to 147.5 mc and adjust coils L2210 and L2218 for maximum amplitude of the 147.5 mc marker.

g. Set the signal generator to 172.5 mc and adjust coils L2207 and L2213 for maximum amplitude of the 172.5 mc marker.

h. Check the curve and rock coils L2204 and L2216 for a symmetrical curve.

i. Adjust coil L2202 for optimum curve at 160 mc and repeat steps f, g and h so that the 147.5 mc markers are 2 db down from the knee of the curve and are symmetrical as shown in figure 3-7a.

j. Turn S2201 to the fully clockwise position (narrow position).

k. Switch the B+ jig to the narrow position.

l. Set the signal generator to 160 mc and adjust coils L2220, L2223, L2239 and L2240 for maximum amplitude of the 160 mc marker.

m. Set the signal generator to 157.5 mc and adjust the coils in step l so that the 157.5 mc marker is 2 db down from the knee of the curve.

n. Set the signal generator to 162.5 mc and adjust the coils in step l so that the 162.5 mc marker is 2 db down from the knee of the curve.

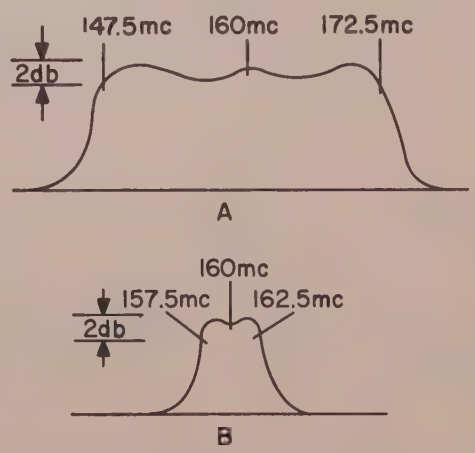


Figure 3-7. Bandwidth for 160-MC, I-F Strip

o. Repeat steps m and n for a bandwidth of 5 mc. Also coils L2223 and L2239 to shift the frequency and rock coils L2220 and L2240 a symmetrical curve. Refer to figure 3-7b.
p. Adjust coil L2238 for optimum curve.
q. Connect the signal generator to the Input of the detector. Connect the Output of the detector to the Vertical Input of the oscilloscope.
r. Set the signal generator to 160 mc, 30 percent modulation at 400 cycles. Set the Attenuator on the signal generator to 5 dbm. Adjust the oscilloscope for 20 units of deflection.
s. Connect the 160-MC, I-F strip between the signal generator and the detector.
t. Set switch S2201 on the I-F strip fully clockwise and then back off one position.
u. Reduce the Attenuator setting on the signal generator to obtain 20 units of deflection on the oscilloscope. Record the Attenuator setting.
v. Set switch S2201 on the I-F strip fully clockwise.
w. Repeat step u.
x. The readings obtained in steps u and w must be within 2 dbm.

3-36. TEST OF THE FILTER STRIP.

3-37. TEST EQUIPMENT REQUIRED.
a. Hewlett Packard Model 608 Signal Generator
b. Kay Megasweep Model 111A Sweep Generator
c. DuMont Oscilloscope Model 304
d. Detector 07000
e. B+ Switching Jig 07401
f. 160-MC, I-F Strip UPM-17
g. Power Supply UPM-17.

3-38. PRELIMINARY PROCEDURE.
a. Turn on the power in the test equipment and allow a 15 minute warmup period.
b. Set up the sweep generator according to the applicable instruction manual.
c. Connect the High Out jack of the sweep generator to the Input side of the detector. Connect the Output side of the detector to the Vertical Input on the oscilloscope.
d. Set the sweep generator for a flat response by setting it in the mode that will give the best presentation on the oscilloscope.
e. Set the Attenuator on the sweep generator and the oscilloscope for 10 vertical units of deflection on the oscilloscope.

NOTE

Do not change this setting throughout the entire procedure.

f. Set the model 608 to 160 mc and adjust the Attenuator so that the marker is visible on the oscilloscope.
g. Vary the signal generator Frequency dial from 145 mc to 125 mc and adjust the sweep generator so that the 145 mc marker is at the low end of the scope presentation and the 175 mc marker is at the high end of the scope presentation. Disconnect the test equipment.
h. Connect the test equipment to the filter as shown in figure 3-8a.

3-39. TEST PROCEDURE.
a. Set the signal generator to 160 mc and adjust

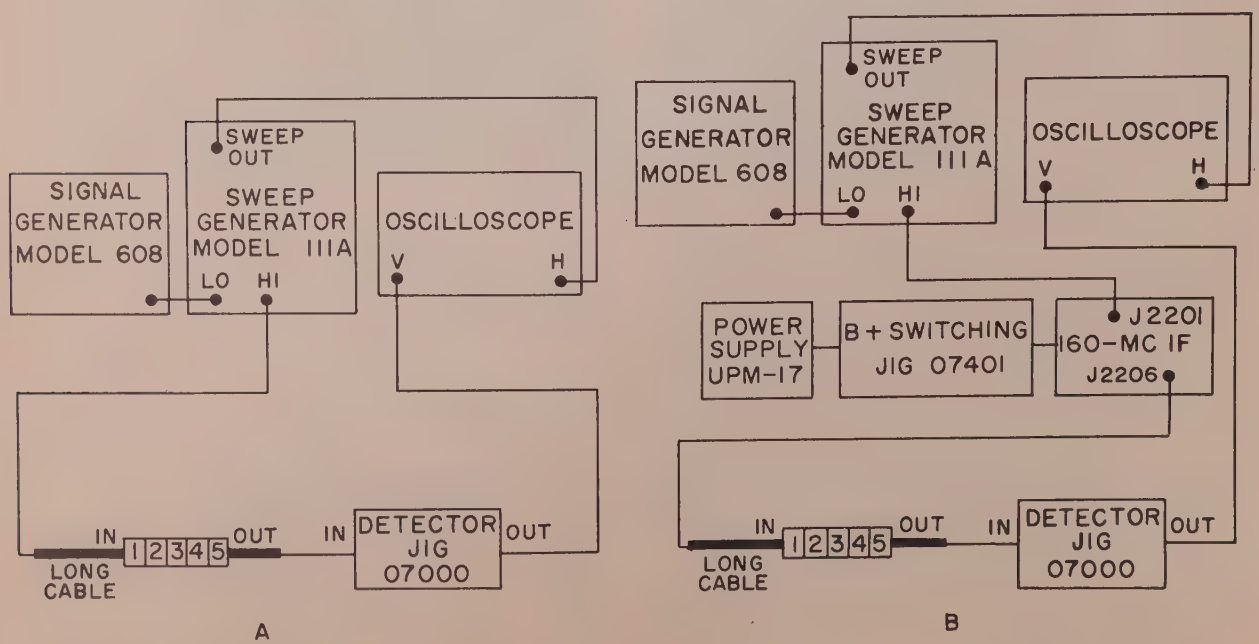


Figure 3-8. Filter Test Setup

the Attenuator until a marker is visible on the oscilloscope.

b. Adjust coils 2, 3 and 4 by expanding or compressing until the 160 mc marker is in the center of the oscilloscope presentation.

c. Adjust coils 1, 2, 3, 4 and 5 until the response is flat and a 145 mc marker appears at the low end and a 175 mc marker appears at the knee of the curve. The presentation on the oscilloscope must be within 9 and 10 units of deflection.

d. Set the marker at 175 mc and vary the Frequency dial on the signal generator to the point at which the curve meets the base line. The frequency at this point must be 185 mc or less. Refer to figure 3-9.

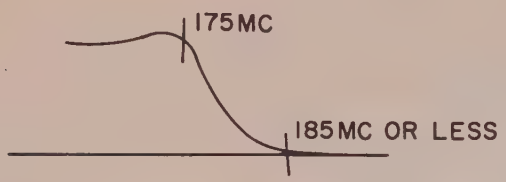


Figure 3-9. Filter Response at High Frequency End

e. Connect the test equipment to the filter as shown in figure 3-8b and check the operation of the filter with the 160-mc I-F strip.

3-40. PULSE ANALYZER INDICATOR IP-130/UPM-17.

3-41. TEST OF 64-MC I-F STRIP. For test setup see figure 3-10.

3-42. TEST EQUIPMENT REQUIRED.

a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Measurements Corp Model 80 Signal Generator
d. Measurements Corp Model 62 R-F Voltmeter
e. Frequency Meter FR-5
f. Regulated Power Supply UPM-17
g. Sweep Frequency Generator UPM-17.

3-43. PRELIMINARY PROCEDURE.

a. Connect the test equipment to the i-f strip as shown in figure 3-10.

b. Turn on the power and allow a 15 minute warm-up period.

3-44. TEST PROCEDURE.

a. Connect the FR-5 to J1101. Set the FR-5 to 64 mc. Set the R-F voltmeter to the 1 volt scale.

b. Set R112 located on the i-f strip to the fully clockwise position.

c. Adjust coils L1101, L1103, L1105 and L1107 and transformer T1102 for a peak signal amplitude on the R-F Voltmeter. Record the r-f voltmeter reading.

d. Lower the frequency of the FR-5 until the output reading on the r-f voltmeter is 3 db lower than that recorded in step c. Record the frequency of the FR-5.

e. Raise the frequency of the FR-5, past the center frequency (64 mc), until the output reading on the r-f voltmeter is 3 db lower than that recorded in step c. Record the frequency of the FR-5.

f. The difference between the frequencies recorded in steps d and e is the total bandwidth. The total bandwidth must not exceed 350 kc.

g. Disconnect the FR-5 from J1101.

h. Connect the Model 80 through the 6 db pad to J1101.

i. Set the Model 80 at about 64 mc for a peak signal output on the r-f voltmeter.

j. Set the Attenuator of the Model 80 for a reading of 0.25 on the r-f voltmeter.

k. The Attenuator reading on the Model 80 must be less than 250 uv.

3-45. TEST OF 1-MC I-F STRIP.

3-46. TEST EQUIPMENT REQUIRED.

a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Measurements Corp Model 80 Signal Generator
d. Ballantine Model 314 Voltmeter
e. Frequency Meter FR-5
f. Lavoie Oscilloscope LA-239C
g. Regulated Power Supply UPM-17.

3-47. PRELIMINARY PROCEDURE.

a. Connect the test equipment to the i-f strip as shown in figure 3-11.

b. Turn the power on and allow a 15 minute warm-up period.

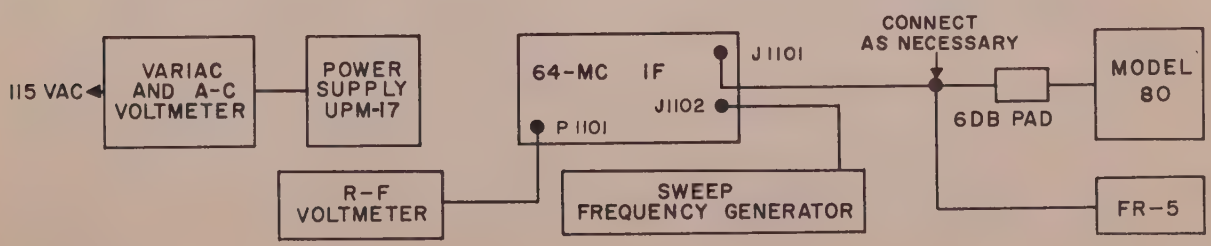


Figure 3-10. 64-MC, I-F Strip Test Setup

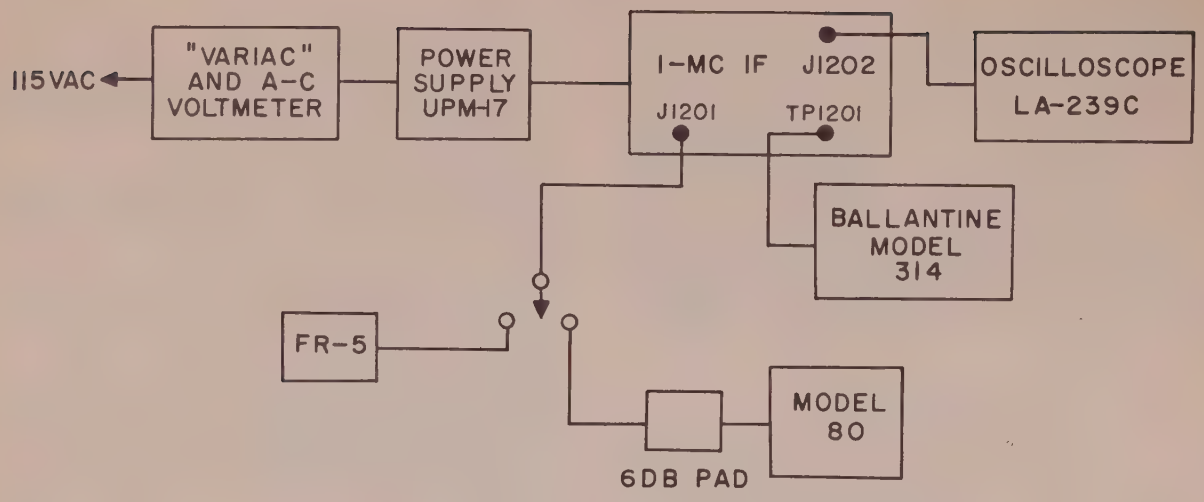


Figure 3-11. 1-MC, I-F Strip Test Setup

3-48. TEST PROCEDURE.

a. Set the FR-5 to 65 mc and connect the FR-5 to J1201 on the i-f strip.

b. Adjust coil L1202 on the i-f strip for a zero beat on the FR-5.

c. Set the FR-5 to coarse and adjust coil L1205 on the i-f strip for a maximum signal indication on the FR-5 panel meter.

d. Repeat step b.

e. Set the FR-5 to 64 mc. Set the Ballantine Voltmeter to the 0.1 volt scale.

f. Adjust transformer T1201, Z1201 and Z1202 for a maximum signal output on the Ballantine Voltmeter. Record the Ballantine Voltmeter reading.

g. Lower the frequency of the FR-5 until the output reading on the voltmeter is 3 db lower than that recorded in step f. Record the frequency of the FR-5.

h. Raise the frequency of the FR-5, past the center frequency (64 mc), until the output reading on the voltmeter is 3 db lower than that recorded in step f. Record the frequency of the FR-5.

i. The difference between the frequencies recorded in step g and h is the total bandwidth. The total bandwidth must not exceed 10 kc.

j. Set the FR-5 accurately to 64 mc.

k. Adjust resistor R1229 for the maximum amplitude, of the 2 mc signal at J1202, obtainable on the oscilloscope.

l. Disconnect the FR-5 from J1201.

m. Connect the Model 80 through the 6 db pad to J1201.

n. Set the Model 80 at about 64 mc for a peak signal output on the Ballantine Voltmeter.

o. Set the Attenuator on the Model 80 for a 0.035 reading on the Ballantine Voltmeter.

p. The Attenuator reading on the model must be less than 350 uv.

3-49. TEST OF SWEEP FREQUENCY GENERATOR.

3-50. TEST EQUIPMENT REQUIRED.

a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. DuMont Model 304 Oscilloscope
d. Measurements Corp Model 59 Grid Dip Meter
e. Saw Tooth Generator Jig 06801
f. Detector Test Jig 07000
g. Shorting Jumper.

3-51. TEST PROCEDURE.

a. Connect the power supply and "VARIAC" jig 06801 to the sweep frequency generator. Ground input cable of the sweep frequency generator. Turn on the power and allow a 15 minute warmup period.

b. Adjust the Potentiometer on jig 06801 to obtain a reading of 141.9 volts on the test jig voltmeter.

c. Set the grid dip meter control to the Diode position and measure the frequency at V1504 on the sweep frequency generator.

d. The frequency reading must be 41.9 ±2 mc. If necessary adjust coil L1504.

e. Adjust the Potentiometer on jig 06801 to obtain a 29.5 volt reading on the test jig voltmeter.

f. Measure the frequency at V1504. The frequency reading must be 32.8 ±2 mc. If necessary adjust coil L1504.

g. Repeat steps b through f until both ends are within tolerance.

h. Connect the test equipment to the sweep frequency generator as shown in figure 3-12. Connect the Vertical Input of the oscilloscope to test point TP1501 on the sweep frequency generator.

i. Set the grid dip meter to CW and couple it to V1501.

j. Set the grid dip meter to 40.5 mc and tune coil L1508 for the signal peak obtainable on the oscilloscope.

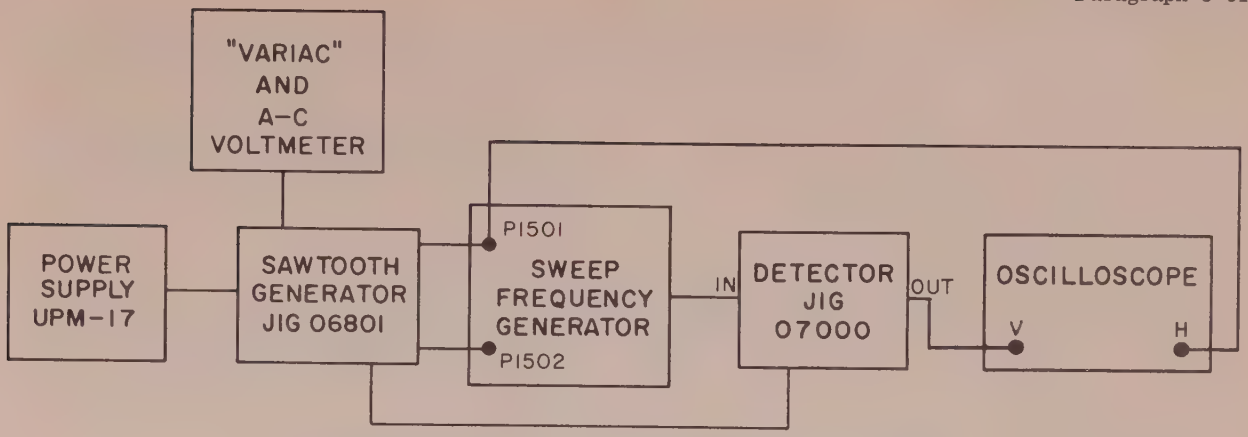


Figure 3-12. Sweep Frequency Generator Test Setup

k. Set the grid dip meter to 34.1 mc and tune coil L1506 for the signal peak obtainable on the oscilloscope.

l. Repeat steps j and k to obtain a curve as shown in figure 3-13a.

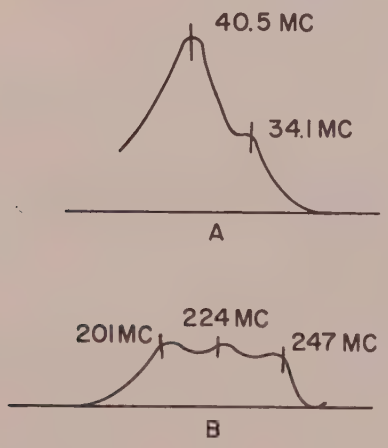


Figure 3-13. Sweep Frequency Generator Waveforms

m. Connect the Vertical Input of the oscilloscope to test point TP1502 on the sweep frequency generator. Connect test point TP1506 to ground with the shorting jumper.

n. Set the grid dip meter to 37.33 mc and tune L1 of 2150 for the signal peak obtainable on the oscilloscope.

o. Remove the shorting jumper from test point TP1506 and tune L2 of 21505 for the minimum indication obtainable on the oscilloscope.

p. Connect the Vertical Input of the oscilloscope to test point TP1503. Connect test point TP1504 to ground with the shorting jumper.

q. With the grid dip meter set to 37.33 mc, tune coil L1514 for the signal peak obtainable on the oscilloscope.

r. Remove the shorting jumper from test point TP1504. Connect test point TP1505 to ground with the shorting jumper.

s. Tune coil L1515 for the peak signal obtainable on the oscilloscope.

t. Remove the shorting jumper from test point TP1505 and tune coil L1522 for the peak signal obtainable on the oscilloscope.

u. Connect the detector jig Input to plug P1503 on the sweep frequency generator. Connect the detector jig Output to the Vertical Input on the oscilloscope.

v. Check the wave shape for the value given in steps w, x, and y. See figure 3-13b.

w. The minimum allowable frequency range must be between 201 mc to 247 mc at a minimum output level of 200 mv.

NOTE

Use the grid dip meter coupled to the detector jig to check the frequency.

x. Set the "VARIAC" to 126 volts. The output level must not exceed 700 mv. Set the "VARIAC" to 103 volts. The output level must not be less than 150 mv.

NOTE

The filament voltage in the sweep frequency generator strip must vary less than 5.67 volts ac or greater than 6.93 volts ac when the "VARIAC" is varied from 103 volts ac to 126 volts ac.

y. The center frequency must be 224 ±3 mc.

z. Connect the sawtooth output of the power supply to plug P1501 on the sweep frequency generator and the Horizontal Input on the oscilloscope.

aa. Set the grid dip meter to 224 mc and couple it to the detector jig.

ab. Set the "SPECTRUM WIDTH" on the power supply to "O."

ac. Vary the Potentiometer on test jig 06801 to obtain a marker on the oscilloscope. The voltage

reading on the test jig meter must be 94 ±15 volts.
ad. Check the wave slope for the values given in steps w, x and y.

3-52. TEST OF POWER SUPPLY AND VIDEO.

3-53. TEST EQUIPMENT REQUIRED.
a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. DuMont Model 304 Oscilloscope
d. Ballantine Model 300 Voltmeter
e. Hewlett Packard Model 200C Audio Oscillator
f. Power Supply Test Jig 07201.

3-54. POWER SUPPLY SECTION.

3-55. PRELIMINARY PROCEDURE.
a. Connect the test equipment to the power supply and video strip as shown in figure 3-14.
b. Turn the power on and allow a 15 minute warm-up period.

3-56. TEST PROCEDURE.
a. Read the test jig voltmeter M1 in both positions of test jig switch S1. The reading observed in both positions must be 6.3 volts ±2 percent.
b. Set test jig switches S2 and S3 in position 1.
c. Vary resistor R1361 from the minimum setting to the maximum setting. The test jig voltmeter M2 reading must vary a minimum of 20 volts. The minimum reading at the maximum setting of R1361 must be +153 volts. The maximum reading at the minimum setting of R1361 must be +147 volts.
d. Adjust R1361 to obtain a reading of +150 volts on the test jig voltmeter.
e. Read the ripple voltage on the Ballantine Model 300 Voltmeter. The reading must be less than 0.001 volts ac.
f. Set test jig switches S2 and S3 to position 2.
g. Vary resistor R1352 from the minimum setting to the maximum setting. The test jig voltmeter M2 reading must vary a minimum of 20 volts. The minimum reading at the maximum setting of R1352 must be -153 volts. The maximum reading at the minimum setting of R1352 must be -147 volts.
h. Adjust R1352 to obtain a reading of -150 volts on the test jig voltmeter.
i. Read the ripple voltage on the Ballantine Model 300 voltmeter. The reading must be less than 0.001 volts ac.
j. Vary the "VARIAC" setting from 103.5 volts ac to 126.5 volts ac and read the test jig voltmeter for positions 1 and 2 of test jig switch S2. The +150 volt and -150 volt readings must remain constant.

3-57. VIDEO SECTION.

3-58. PRELIMINARY PROCEDURE.
a. Connect the test equipment to the power supply and video strip as shown in figure 3-15.
b. Turn on the power and allow a 15 minute warm-up period.

3-59. TEST PROCEDURE.
a. Set the test jig switch S3 to position 3. Set the audio oscillator to 500 cps and set the Gain control to obtain a 0.6 volt ac reading on the Ballantine Voltmeter. Set the Calibrator control on the oscilloscope to obtain 10 units of deflection at 20 volts.
b. Turn resistor R1325 from the full counterclockwise position to the full clockwise position. The voltage reading indicated on the oscilloscope must vary from 0 to 120 volts.
c. Connect the plug P1302 on the power supply strip to the Vertical Input on the oscilloscope.
d. Set the audio oscillator frequency control 20, 50, 500, 1kc, 5kc and 8kc and vary the Gain control so that the output as indicated on the oscilloscope is 100 volts. Record the db input level on the Ballantine Voltmeter at each frequency. The voltmeter reading for each frequency must be constant within 2 db.
e. Disconnect the plug P1302 from the oscilloscope and reconnect it to the test jig.
f. Set the test jig switch S3 to position 4. Set resistors R1325 and R1314 to the full clockwise position. Set the audio oscillator to 500 cps and the Gain control to obtain 0 volts on the Ballantine Voltmeter.
g. Increase the audio oscillator Gain control until the sine wave displayed on the oscilloscope begins to distort and square. The Ballantine Voltmeter reading must be less than 0.03 volt ac.

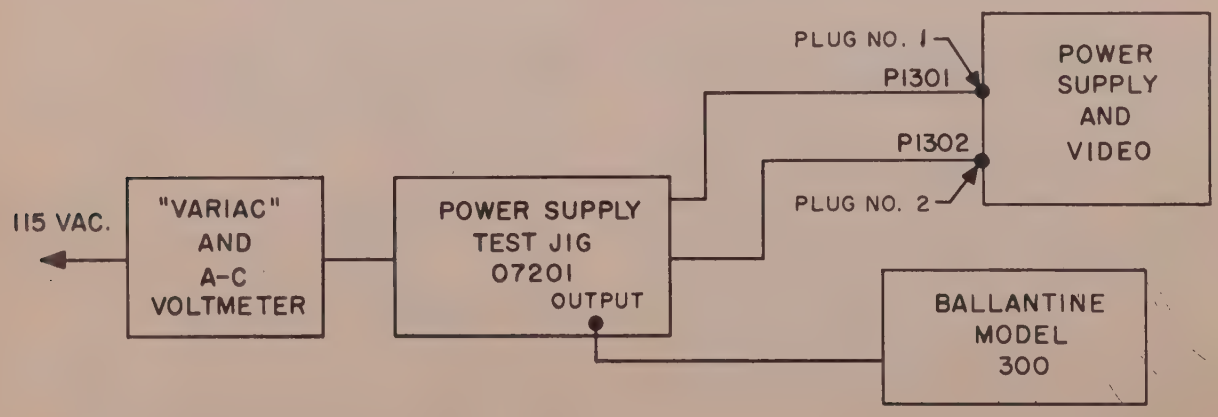


Figure 3-14. Power Supply Section Test Setup

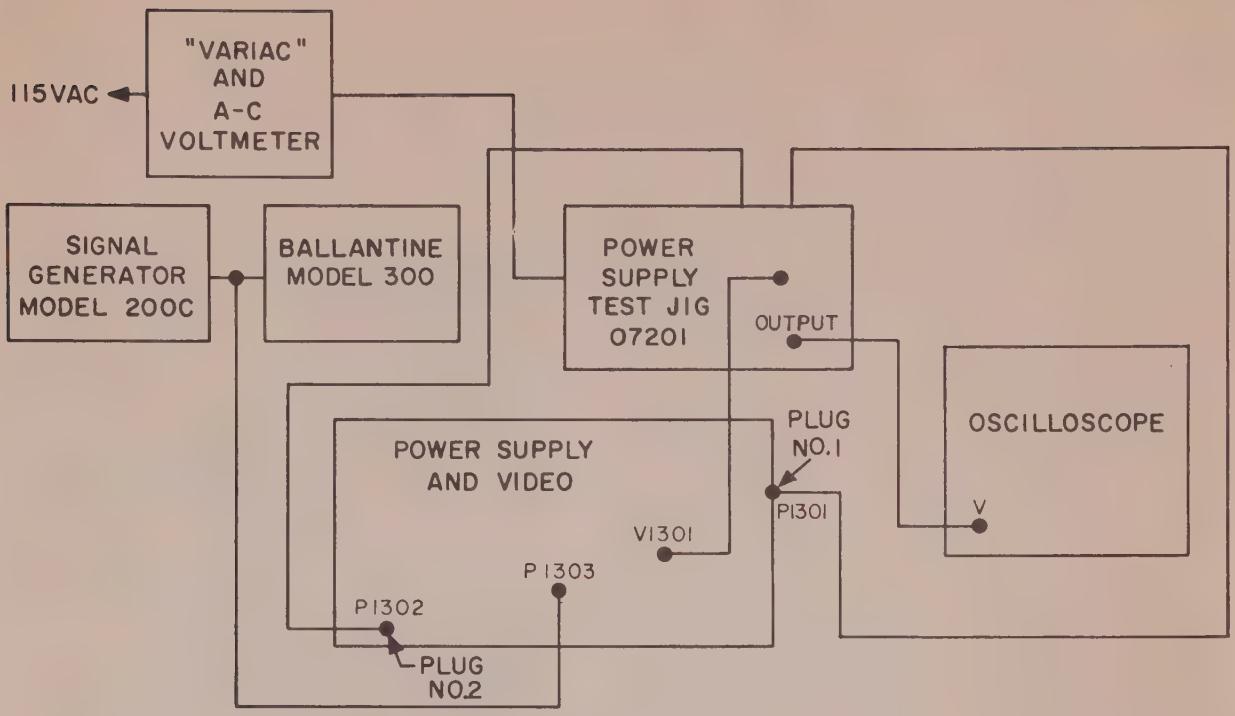


Figure 3-15. Video Section Test Setup

h. Increase the audio oscillator Gain control until the square wave displayed on the oscilloscope reaches saturation. The square wave amplitude must be greater than 50 volts as measured on the oscilloscope.

i. Set the test jig switch S3 to position 5. Disconnect the audio oscillator from plug P1303 and connect it to the Horizontal Input on the oscilloscope.

j. Turn resistor R1307 to the full clockwise position and then back off about 10 degrees. Set the audio oscillator for 30 cps and adjust resistor R1304 to obtain a one to one ratio as indicated on the oscilloscope.

k. Check the frequency range of resistor R1307 by using the ratio of the audio oscillator against the sawtooth output. The minimum frequency range required must be from 5 cps to 30 cps.

l. Set the controls on the video strip as follows: resistor R1301 to the center position; resistors R1314, R1307, R1365 and R1313 to the full clockwise position; set resistor R1310 to the position that produces the same sawtooth amplitude on the oscilloscope for any setting of R1307.

m. The sawtooth amplitude indicated on the oscilloscope must be 55 volts or greater for each frequency setting.

n. Set the test jig switch S3 to position 6. Adjust the Sweep Range and Sweep Vernier controls on the oscilloscope until the waveshape is almost stationary.

o. By adjusting resistor R1301 on the video strip the waveshape on the oscilloscope must become synchronized.

p. Set the test jig switch S3 to position 7.

q. Set the controls on the video strip as follows: resistors R1301 and R1323 to the center position; resistor R1307 to the full clockwise position; resistor R1310 to the same position as set in step l.

r. Vary resistor R1317 from the full counterclockwise position to the full clockwise position. The minimum amplitude variation as indicated on the oscilloscope must be 280 volts.

s. Set resistor R1317 to the full counterclockwise position and vary resistor R1323 from the full counterclockwise position to the full clockwise position. The horizontal d-c level indicated on the oscilloscope must vary a minimum of 100 volts on each side of 0 volts.

t. Set the test jig switch to position 3.

u. Set resistor R1325 to the full counterclockwise position and vary resistor R1336 from the full counterclockwise position to the full clockwise position. The vertical d-c level indicated on the oscilloscope must vary a minimum of 100 volts on each side of 0 volts.

3-60. TEST OF THE SPECTRUM CALIBRATOR.

3-61. TEST EQUIPMENT REQUIRED.

a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Frequency Meter FR-6
d. Ballantine Model 314 Voltmeter
e. Regulated Power Supply UPM-17
f. "IF ATTENUATION -DB" Switch UPM-17.

3-62. PRELIMINARY PROCEDURE.

a. Connect the test equipment to the spectrum calibrator as shown in figure 3-16.

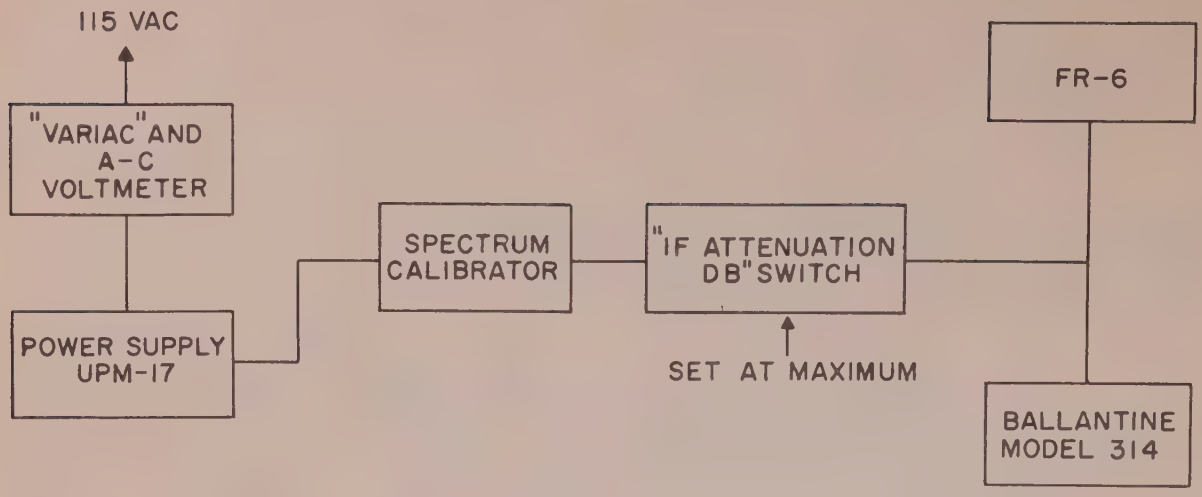


Figure 3-16. Spectrum Calibrator Test Setup

b. Turn on the power and allow a 15 minute warm-up period.

3-63. TEST PROCEDURE.

a. Set the FR-6 to 147.5 mc, 152.5 mc, 167.5 mc, and 172.5 mc respectively. Zero beat the spectrum calibrator against the FR-6 at each setting by varying the calibrator shaft. Record the Ballantine Voltmeter reading of the calibrator output at each setting.

b. The minimum frequency range required of the spectrum calibrator must be from 147.5 mc to 172.5 mc.

c. Adjust C1408 on the spectrum calibrator until the calibrator output, recorded in step a, is flat within 2 db.

3-64. TEST OF THE HIGH VOLTAGE POWER SUPPLY.

3-65. TEST EQUIPMENT REQUIRED.

a. "VARIAC" General Radio Type J-10MT
b. A-C Voltmeter AN/PSM-3
c. Triplett Model 630 Multitester
d. Ballantine Model 300 Voltmeter.

3-66. PRELIMINARY PROCEDURE.

WARNING

The high voltages used in this power supply are dangerous to life. Maintenance personnel must at all times observe all safety precautions. Always turn off all power before connecting any test equipment.

a. Connect the "VARIAC" and A-C Voltmeter to pins B and C of connector J1601 on the high voltage power supply.

b. Turn on the power and allow a 15 minute warm-up period.

c. Set the "VARIAC" to obtain a 115 volt reading on the A-C Voltmeter.

3-67. TEST PROCEDURE. Check the high voltage power supply for the values at the appropriate test points given in table XII.

TABLE XII. HIGH VOLTAGE POWER SUPPLY CHECKS

Step	Test Point	Test Equipment	Voltage	Tolerance
1	J1602 to J1603	Triplett Model 630, 12 vac scale	6.3 vac	±0.15 vac
2	P1601 (red) to chassis grid	Triplett Model 630, 6000 vdc side	+1500 vdc	±100 vdc
3	J1604 (white) to chassis grid	Same as step 2	-1500 vdc	±100 vdc
4	TP1602 to chassis grid	Triplett Model 630, 300 vdc scale	+158 vdc	±8 vdc
5	TP1602 to chassis grid	Same as step 4	-162 vdc	±8 vdc
6	Same as step 4	Ballantine Model 300, 10 volt scale	0 vac	1.5 vac
7	Same as step 5	Same as step 6	0 vac	1.5 vac

SECTION IV

DISMANTLING AND DISASSEMBLY

4-1. GENERAL.

4-2. This section describes the preliminary procedures to be followed in order to prepare the spectrum analyzer for overhaul. Procedures are given on removing the spectrum analyzer from the transit case, dismantling the equipment components and assemblies, and disassembling the subassemblies and detail parts. Disassembly instructions are limited to the removal of mechanical items only.

4-3. REMOVAL OF EQUIPMENT FROM TRANSIT CASE.

4-4. Remove the spectrum analyzer from the transit case as follows:

a. Lift up the eight latches which secure the top cover of the transit case to the box. Remove the top cover.

b. Unscrew the four wing nuts and remove the corresponding retaining plates in the interior corners of the case to remove the spectrum analyzer from the transit case.

c. Lift the analyzer out of the case carefully by grasping the handle bars of the instrument. Place analyzer carefully on work bench.

d. Remove the r-f attenuators from the metal container on the interior of the top cover by detaching the metal clamps which secure the attenuators to the case mounting.

e. Remove the test cables from the other metal container.

4-5. DISMANTLING.

4-6. SPECTRUM ANALYZER. Dismantle the Pulse Analyzer Indicator IP-130/UPM-17 and the R-F Tuner TN-188/UPM (1 and 2, figure 4-1) from the instrument case (4) as follows:

NOTE

Before dismantling the spectrum analyzer make certain that the power cable at the rear of the instrument is removed from the case receptacle.

a. Loosen four screws, two on each side of the instrument case, and unscrew 15 indicator-drawer panel screws to prepare for removal of indicator unit from the case. Do not remove the drawer at this time.

b. Unscrew 15 screws on the r-f tuner drawer panel. Pull out tuner drawer sufficiently (as shown in figure 4-1) to gain access to the cable (3) and its receptacle.

c. Disconnect the plug of cable (3) from the receptacle. Carefully remove the indicator drawer and the attached cabling (3) from the case. Place the unit on a work bench.

d. Carefully remove the tuner drawer from the case and place the unit on a work bench.

4-7. PULSE ANALYZER INDICATOR IP-130/UPM-17. Dismantle the indicator unit (figure 4-2) as follows:

a. Remove the top cover (2) and rear cover (3) of the indicator unit by unscrewing the attaching screws.

b. Remove all cables secured to the sweep frequency generator (4), the 64 mc i-f amplifier (5), the 1 mc i-f amplifier (6), the power supply and video chassis (7), the high voltage power supply (9) and the spectrum calibrator (8) to prepare each assembly for dismantling from the indicator drawer (10).

c. Withdraw the sweep frequency generator (4), a plug-in unit, from the indicator drawer (10). Withdraw the 64 mc i-f amplifier (5), a plug-in unit, from the drawer. Withdraw the 1 mc i-f amplifier (6), a plug-in unit, from the drawer.

d. Remove the control knobs (1) identified on the indicator drawer panel as "HORIZ CENTERING," "VERT CENTERING," "HORIZONTAL GAIN," "VERTICAL GAIN," "SWEEP FREQ" and "SPECTRUM WIDTH." Removal of the above knobs permits the power supply (7) to be dismantled from the drawer. Remove the remaining eight control knobs on the indicator drawer panel.

e. Pull out the power supply and video chassis (7), another plug-in unit, from the indicator drawer by grasping the handle bar at the rear of the chassis.

f. Remove the spectrum calibrator (8) from the indicator drawer by first unscrewing six screws which secure the chassis to the drawer and then pulling the chassis until the plug-in pins are released from the receptacle of the drawer. Lift out carefully and place the chassis on the bench.

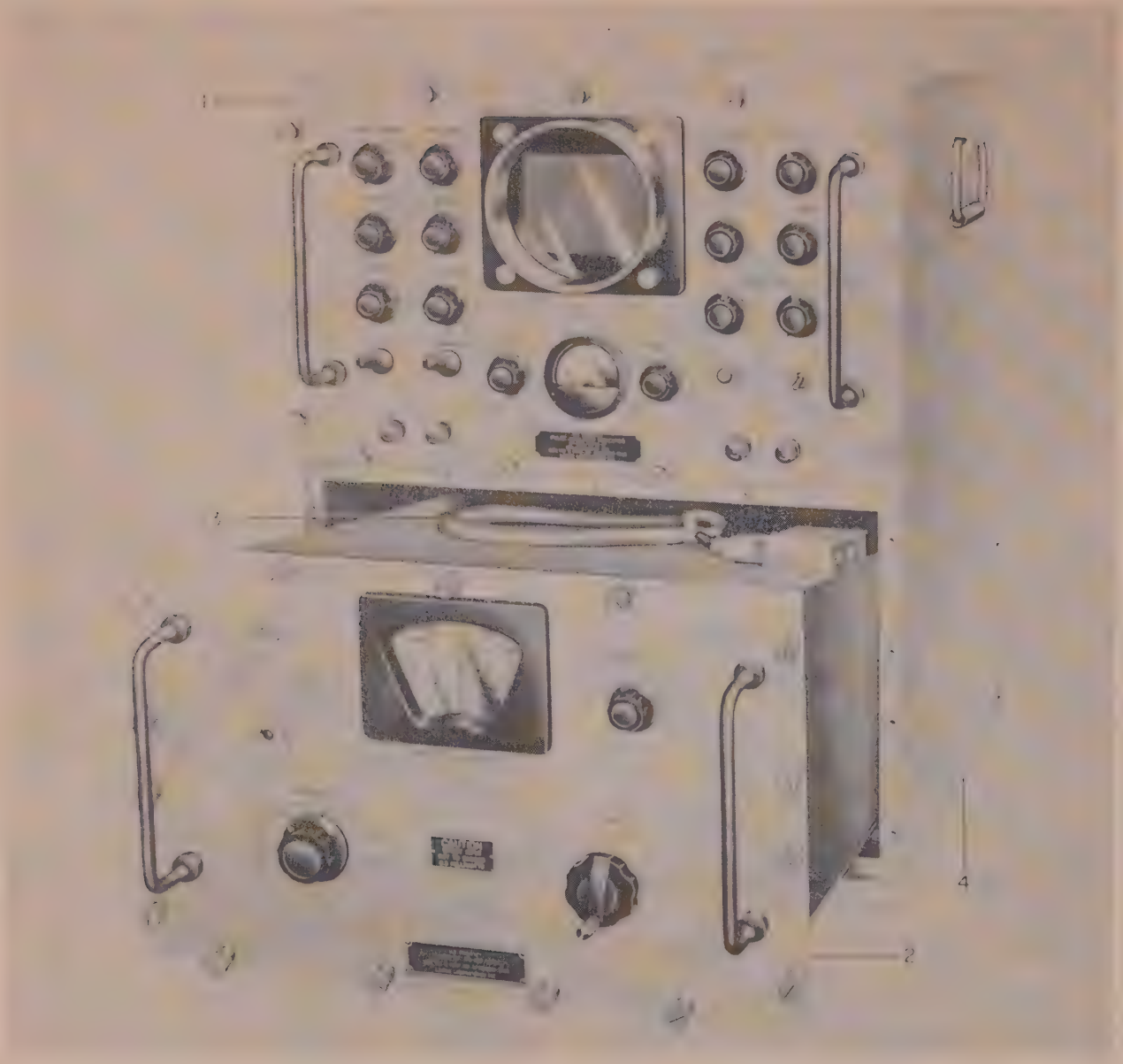
g. Remove the high-voltage power supply (9) from the indicator drawer by unscrewing seven screws which secure the chassis to the drawer.

4-8. R-F TUNER TN-188/UPM. Dismantle the tuner drawer unit shown in figure 4-3 as follows:

a. Remove knobs (1, 2, 3) and top cover and rear cover (4 and 5) from the tuner unit.

b. Remove two handles (6) by unscrewing four nuts on the interior of the tuner unit that secure the handles to the panel. The threaded collars (7) will remain on the handles upon removal.

c. Take off panel assembly (8) by removing four screws securing the panel to the tuner unit frame, and by disconnecting all interior cables attached to the panel and unsoldering all external leads from the i-f attenuator switch. The panel assembly will fall free.



1. Spectrum analyzer
2. R-F tuner
3. Cable
4. Instrument case

Figure 4-1. Spectrum Analyzer

d. Remove dial (11) by unhooking index (10) from hub (9), and removing three set screws that secure the dial to hub and gear (12). Remove hub (9) by removing retaining ring. Lift out hub and gear (12).

e. Remove dial light assembly (14) by detaching all external wiring from dial light assembly terminals and removing the bracket (15).

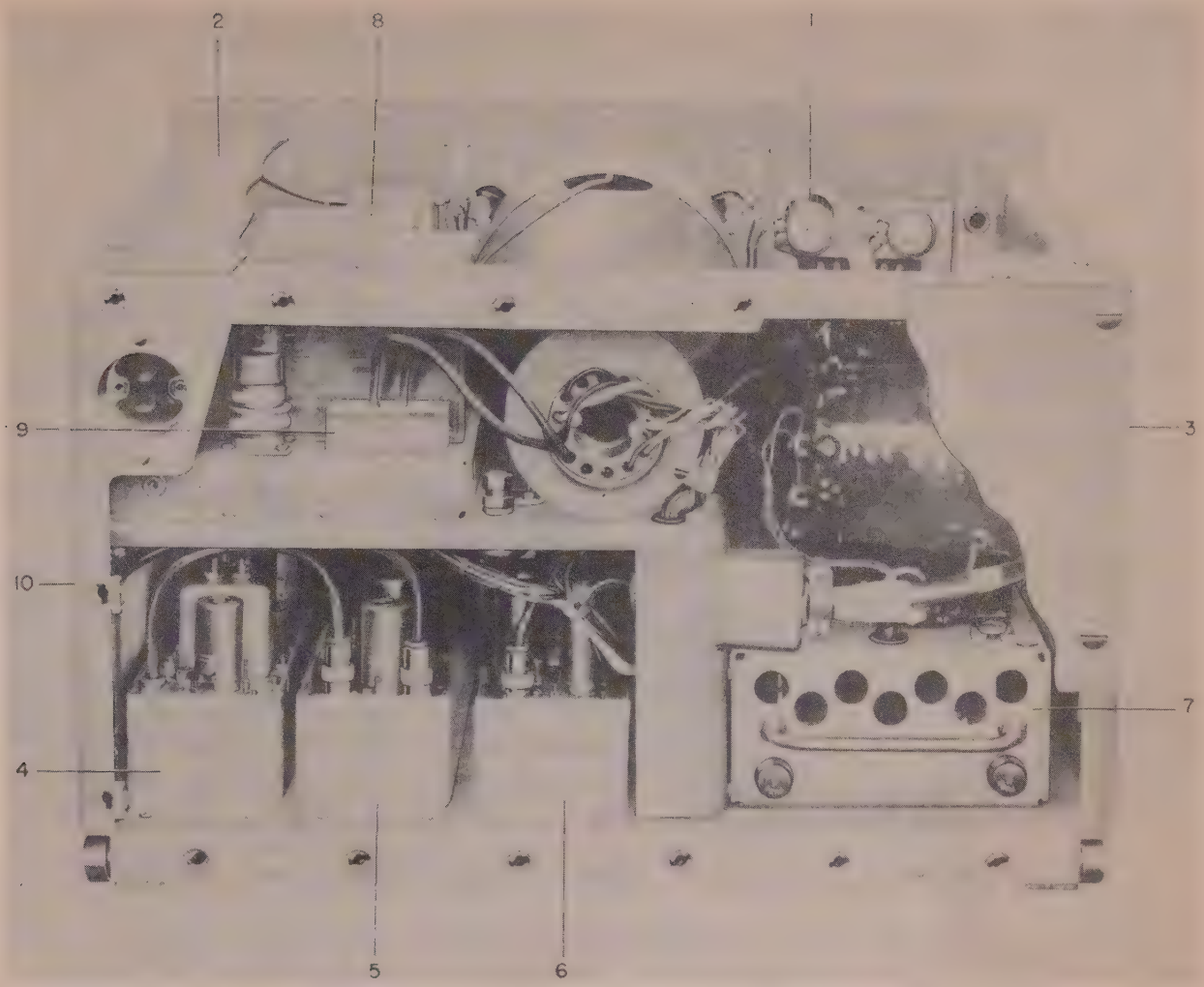
f. Prepare to remove from the tuner unit the 160 mc i-f amplifier (48), oscillator 1 and 2 (22), oscillator 3 (19) and oscillator 4 (16) by detaching all necessary cables from each and detaching the shaft (47) from the 160 mc i-f amplifier.

g. Remove the 160 mc i-f amplifier, a plug-in unit, by pulling the amplifier from the tuner drawer receptacle and carefully lifting the chassis upwards from the tuner drawer.

h. Remove i-f amplifier receptacle from bracket (49) and detach cable clamps from the bracket. Remove two mounting brackets (50) to detach the other cable receptacle located on top of the tuner drawer. Arrange the detached cabling to permit removal of remaining assemblies.

i. Remove bracket (49) from the tuner drawer. Remove cables (25 and 29) from the drawer by removing receptacles (24 and 28).

j. Remove oscillator 1 and 2 by detaching the shaft coupling (21) and unscrewing the screws that secure the oscillator to the base plate (51). Carefully



1. Control knobs
2. Top cover
3. Rear cover
4. Sweep frequency generator
5. I-F Amplifier, 64 mc
6. I-F Amplifier, 1 mc
7. Power supply and video chassis
8. Spectrum calibrator
9. HV power supply
10. Indicator drawer

Figure 4-2. Pulse Analyzer Indicator IP-130/UPM-17, Rear Interior View

lift out the oscillator from the drawer.

k. Remove the cover (16) from oscillator 4 by removing six bolts, three on each side of the cover. Removal of the cover will reveal five external wires attached to the side terminal of the oscillator. Unsolder the five wires.

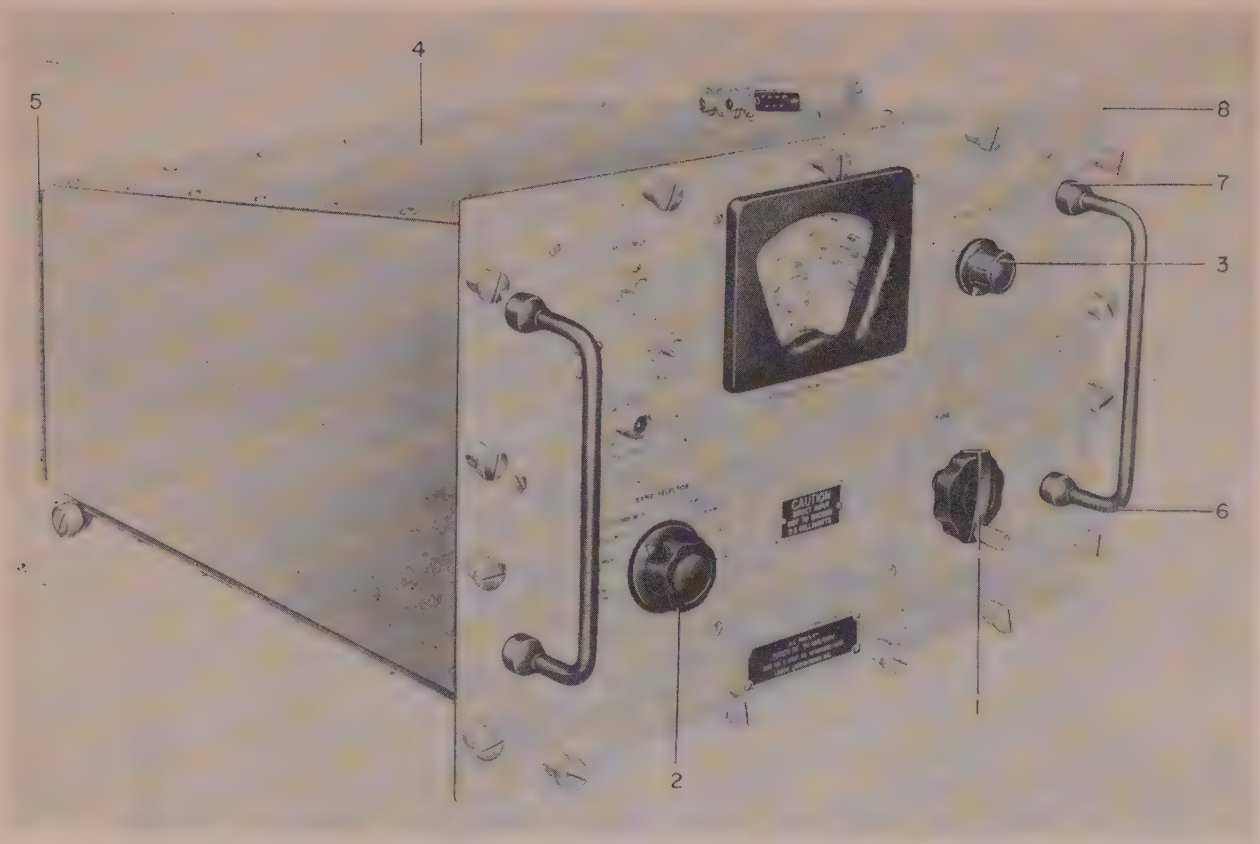
l. Remove the screws that attach the five movable rods of the oscillator to the triangular brass carriage (see figure 4-14). Remove the three screws that attach the three fixed carriage rods to the plate of the gear train assembly. Remove four screws that secure the two bracket supports of the oscillator to the base of the drawer.

m. Carefully pull out the oscillator to detach both the fixed and movable rods from the triangular brass carriage. Lift out the oscillator from the drawer. The brass carriage will remain on the worm gear. Remove the carriage by rotating it around the worm gear until it falls free.

n. Remove oscillator 3 (20, figure 4-3) by removing the cover (19) and by following steps k through n. The removal of oscillator 3 (see figure 4-13) is similar to the removal procedures given for oscillator 4.

o. Remove the gear train assembly (13, figure 4-3) from the base plate (51) by unscrewing eight screws which secure the plate of the gear train assembly with the base plate. Carefully place the gear train assembly on a work bench.

p. Dismantle the base plate (51) by removing four bolts securing the plate to the frame of the tuner drawer. Lift the base plate from the tuner drawer



1. Spinner knob
2. Band selector knob
3. Knob
4. Top cover
5. Rear cover
6. Drawer handle
7. Collar
8. Panel assembly

Figure 4-3. R-F Tuner TN-188/UPM (Sheet 1 of 3 sheets, Index Nos. 1 through 8)

and place on a work bench.

4-9. DISASSEMBLY.

4-10. PULSE ANALYZER INDICATOR IP-130/UPM-17 ASSEMBLIES. Disassemble electrical parts from the six assemblies of the Pulse Analyzer Indicator IP-130/UPM-17 only if such parts are defective and require replacement. The six assemblies are the sweep frequency generator (figure 4-4), the 64 mc i-f amplifier (figure 4-5), the 1 mc i-f amplifier (figure 4-6), the power supply and video chassis (figure 4-7), the high voltage power supply (figure 4-8), and the spectrum calibrator (figure 4-9).

4-11. INDICATOR DRAWER. Disassemble the indicator drawer 11, shown in figure 4-10 as follows:

a. Prepare to disassemble the cathode-ray tube and tube shield (10 and 9) by removing all attached wiring to the two parts.

b. Remove the tube socket and clamp (2 and 3) from the tube base by removing the attaching hardware.

c. Remove the two lamps and two lamp holders (5 and 6) from the tube shield. Remove the two brackets (7). Remove two lampholder retainers (8). Remove two screws to detach the tube shield from the indicator drawer.

d. Remove bezel assembly (11) by unscrewing the four knurled cap nuts. Remove reticle (12), light window (13) and filter (14).

e. Carefully lift the cathode-ray tube and shield out of the indicator drawer.

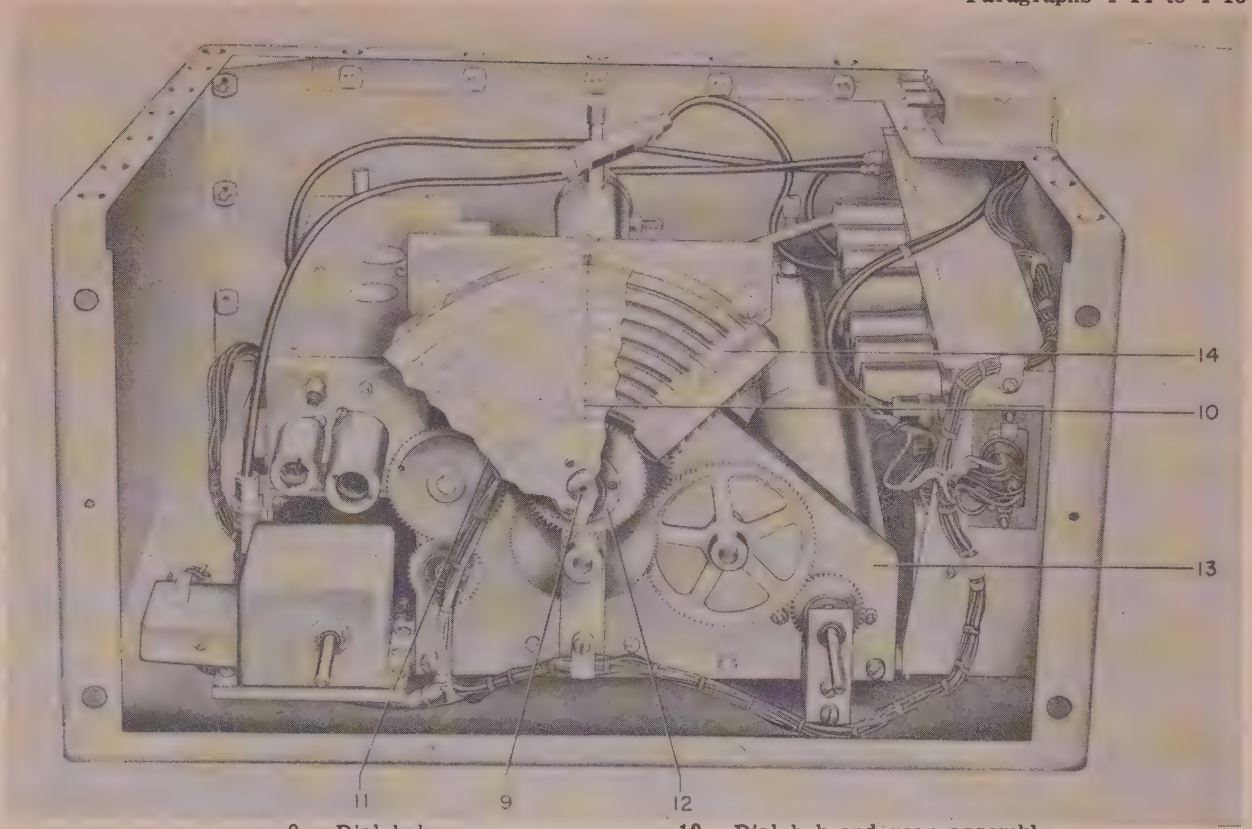
f. Disassemble parts (17 through 37) in proper sequence from the indicator drawer. In removing the two drawer handles (35), unscrew the nuts on the interior of the indicator drawer panel.

g. Disassemble parts (38 through 68) in proper sequence from the indicator drawer.

h. Disassemble parts (69 through 80) in proper sequence from the indicator drawer.

4-12. R-F TUNER TN-188/UPM ASSEMBLIES.

4-13. GENERAL. Disassemble the dial light assembly (figure 4-11), oscillator 1 and 2 (figure 4-12), oscillator 3 (figure 4-13), and oscillator 4 (figure 4-14) only to the extent indicated by the disassembly instructions provided. Do not attempt to disassemble the gear train assembly into basic parts. If any part of the gear train assembly is defective, replace the entire assembly.



9. Dial hub
10. Index
11. Dial
12. Dial hub and gear assembly
13. Gear train assembly
14. Dial light assembly

Figure 4-3. R-F Tuner TN-188/UPM (Sheets 2 of 3 Sheets, Index Nos. 9 through 14)

4-14. DIAL LIGHT ASSEMBLY. Disassemble the dial light assembly (figure 4-11) as follows:

a. Unsolder all wires from the terminals of the two terminal blocks (6) to release the cable (7) from the dial light assembly.

b. Remove the 16 indicator lamps (1) by removing 16 screws on the terminal blocks. Sixteen washers, and contacts (4), lugs (2 and 3) will fall free. The indicator lamps can now be released.

c. Remove the dial guide shaft (9) and dial guide (10) from the dial assembly. Remove the spring index (8).

4-15. OSCILLATOR 1 AND 2. Disassemble oscillator 1 and 2 (figure 4-12) as follows:

a. Remove side cover (2) of oscillator assembly by unscrewing 12 screws.

b. Remove top and rear side cover (5) by removing 19 attaching screws.

c. Remove the shaft and mounting assembly, consisting of block (9), block (12), bar (19) and worm gear (16), by removing six screws and washers. Remove block (19) from blocks (9 and 12), by unscrewing two screws.

d. Remove the worm gear (16) from blocks (9 and 12).

e. Remove two gear assemblies (6) by detaching the anti-backlash springs, unscrewing all set screws, and carefully lifting gears from the variable capacitor shafts.

4-16. OSCILLATOR 3. Disassemble oscillator 3 (figure 4-13) as follows:

a. Unscrew cap (1) to gain access to crystal (2). Using blunt tweezers, carefully remove crystal (2) from crystal cavity (3).

b. Remove end cap (4) by removing three screws. Using proper tools, pull out tube (5).

c. Do not attempt to disassemble oscillator 3 further.

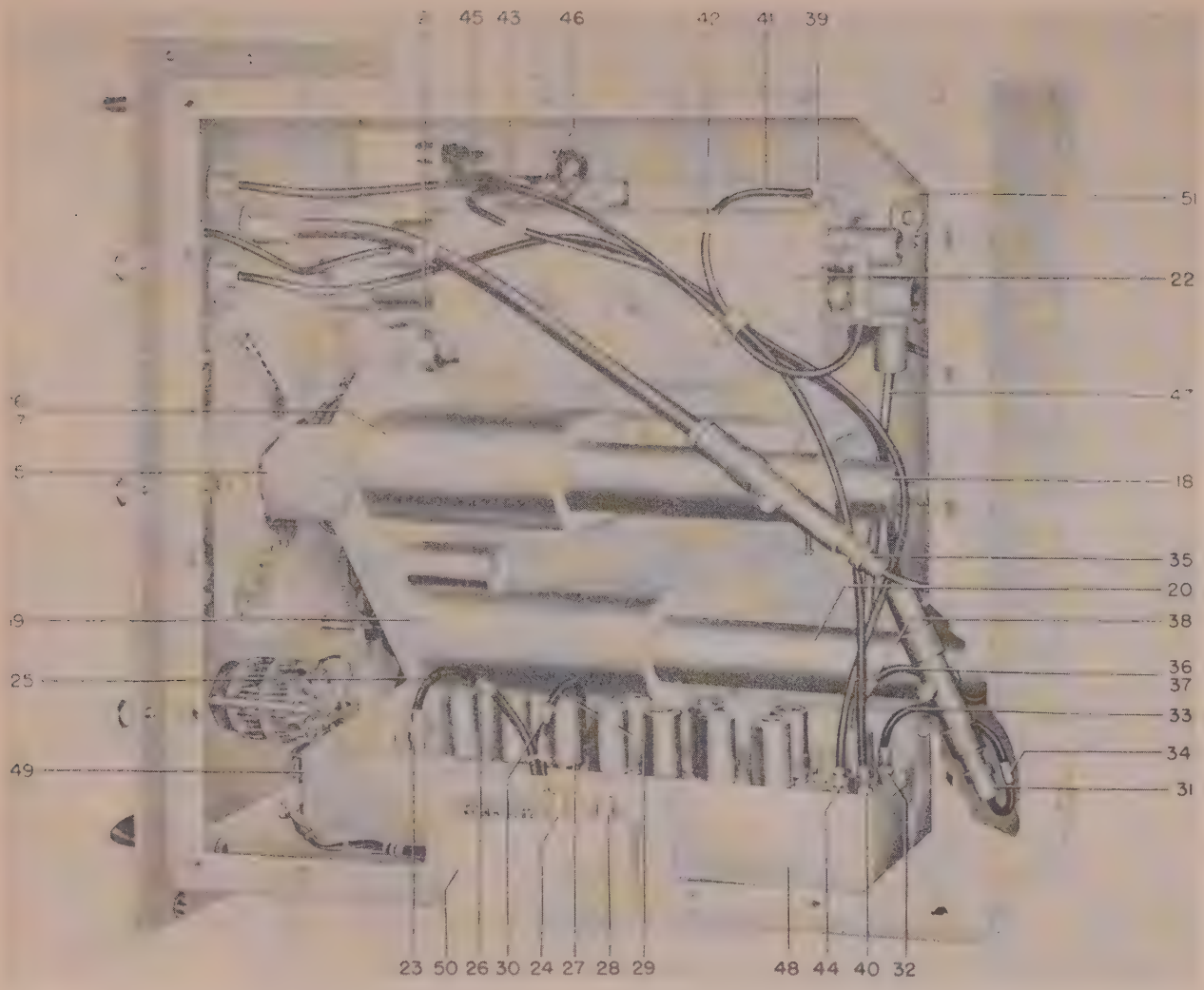
4-17. OSCILLATOR 4. Disassemble oscillator 4 (figure 4-14) as follows:

a. Unscrew cap (1) to gain access to crystal (2). Using blunt tweezers, carefully remove crystal (2) from crystal cavity (3).

b. Remove end cap (4) by removing three screws. Using proper tools, pull out tube (5).

c. Do not attempt to disassemble oscillator (4) further.

4-18. I-F AMPLIFIER - 160 MC. Disassemble the electrical parts of the 160 mc i-f amplifier (figure 4-15) only if such parts are defective and require replacement, or if it is necessary to inspect a part properly.



15. Light bracket
16. Oscillator cover
17. Oscillator 4
18. End cap
19. Oscillator cover
20. Oscillator 3
21. Shaft coupling
22. Oscillator 1 and 2
23. Plug connector
24. Receptacle connector
25. RF cable
26. Identification plate
27. Shield tube
28. Receptacle connector
29. RF cable
30. Identification plate
31. Plug connector
32. Plug connector
33. RF cable
34. Identification plate
35. Plug connector
36. RF cable
37. RF cable
38. Identification plate
39. Plug connector
40. Plug connector
41. RF cable
42. Identification plate
43. Plug connector
44. Plug connector
45. RF cable
46. Identification plate
47. Band selector shaft
48. IF Amplifier, 160 mc
49. Bracket
50. Bracket
51. Base plate

Figure 4-3. R-F Tuner TN-188/UPM (Sheet 3 of 3 Sheets, Index Nos. 15 through 51)

Legend for Figure 4-4

1.	Tube shield	42.	Fixed resistor
2.	Tube shield	43.	Fixed resistor
3.	Tube shield	44.	Fixed resistor
4.	Electron tube	45.	Fixed resistor
5.	Electron tube	46.	Fixed resistor
6.	Electron tube	47.	Fixed resistor
7.	Tube socket	48.	Fixed resistor
8.	Tube socket	49.	Fixed resistor
9.	Indicator unit cover	50.	Fixed resistor
10.	Grounding clip	51.	Fixed resistor
11.	Receptacle connector	52.	Fixed resistor
12.	Receptacle connector	53.	Fixed resistor
13.	Receptacle connector	54.	Fixed resistor
14.	Lug terminal	55.	Fixed resistor
15.	Coil	56.	Fixed resistor
16.	Adjustable tuning core	57.	Fixed capacitor
17.	Coil	58.	Fixed capacitor
18.	Network	59.	Lug terminal
19.	Fixed capacitor	60.	Fixed capacitor
20.	Coil	61.	Coil
21.	Coil	62.	Coil
22.	Coil	63.	Coil
23.	Adjustable tuning core	64.	Buss
24.	Adjustable tuning core	65.	Strap nut
25.	Alignment pin	66.	Strap nut
26.	Plug connector	67.	Fixed capacitor
27.	Plug connector	68.	Capacitor mounting
28.	Cable	69.	Quartz crystal unit
29.	Plug connector	70.	Receptacle connector
30.	Plug connector	71.	Receptacle connector
31.	Cable	72.	Fixed capacitor
32.	Receptacle connector	73.	Fixed capacitor
33.	Lug terminal	74.	Fixed capacitor
34.	Binding post	75.	Fixed capacitor
35.	Fixed capacitor	76.	Fixed capacitor
36.	Capacitor mounting	77.	Fixed capacitor
37.	Fixed resistor	78.	Fixed capacitor
38.	Fixed resistor	79.	Fixed capacitor
39.	Fixed resistor	80.	Fixed capacitor
40.	Fixed resistor	81.	RF choke
41.	Fixed resistor	82.	Chassis

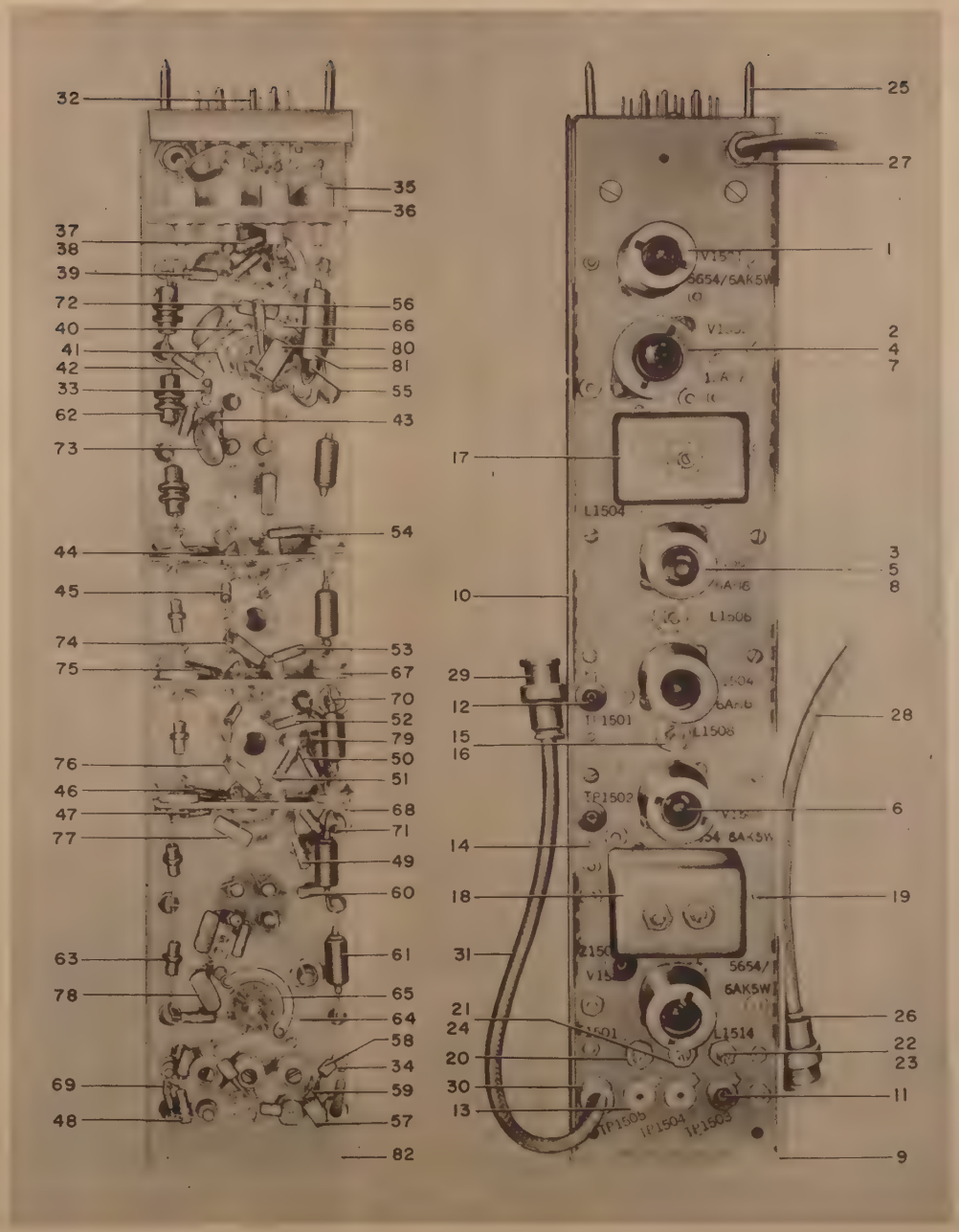


Figure 4-4. Sweep Frequency Generator

Legend for Figure 4-5

1. Tube shield
2. Electron tube
3. Electron tube
4. Tube socket shield
5. Tube socket
6. Tube socket
7. Amplifier cover
8. Grounding clip
9. Receptacle connector
10. Variable resistor
11. Shaft lock
12. Coil
13. Coil
14. Adjustable tuning core
15. Adjustable tuning core
16. Terminal mounting
17. Terminal mounting
18. Lug terminal
19. Fixed resistor
20. Fixed resistor
21. Fixed resistor
22. Fixed resistor
23. Fixed resistor
24. Fixed resistor
25. Fixed resistor
26. Fixed resistor
27. Fixed resistor
28. Fixed resistor
29. Fixed capacitor
30. Capacitor mounting
31. Alignment pin
32. Receptacle connector
33. Lug terminal
34. Fixed capacitor
35. Fixed capacitor
36. Fixed capacitor
37. Fixed capacitor
38. Fixed capacitor
39. Fixed capacitor
40. Coil
41. Coil
42. Coil
43. Buss
44. Chassis

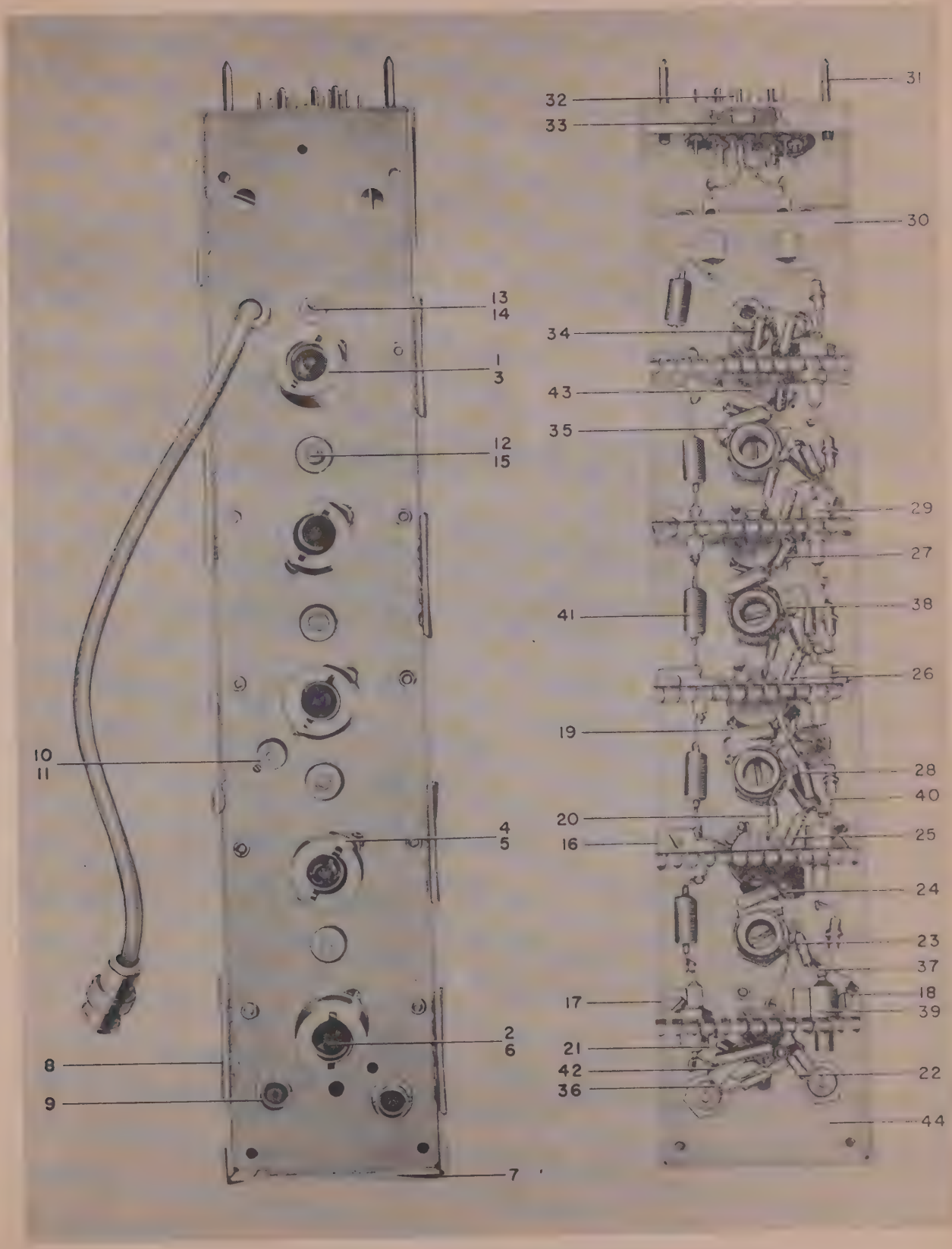


Figure 4-5. I-F Amplifier 64 MC

Legend for Figure 4-6

1. Tube shield
2. Tube shield
3. Tube shield
4. Electron tube
5. Electron tube
6. Electron tube
7. Electron tube
8. Tube socket
9. Screw
10. Washer
11. Nut
12. Tube socket
13. Unit crystal
14. Crystal unit holder
15. Coil
16. Coil
17. Coil
18. Adjustable tuning core
19. Adjustable tuning core
20. Receptacle connector
21. Telephone jack
22. Grounding lug
23. Variable resistor
24. Shaft lock
25. Coil
26. Amplifier cover
27. Grounding clip
28. Terminal mounting
29. Binding post
30. Lug terminal
31. Fixed capacitor
32. Capacitor mounting
33. Alignment pin
34. Receptacle connector
35. Lug terminal
36. Buss
37. Fixed capacitor
38. Fixed capacitor
39. Fixed capacitor
40. Fixed capacitor
41. Fixed capacitor
42. Fixed capacitor
43. Fixed capacitor
44. Fixed capacitor
45. Fixed capacitor
46. Fixed capacitor
47. Fixed capacitor
48. RF choke
49. Crystal socket
50. Coil
51. Coil
52. Coil
53. Coil
54. Stud terminal
55. Fixed resistor
56. Fixed resistor
57. Fixed resistor
58. Fixed resistor
59. Fixed resistor
60. Fixed resistor
61. Fixed resistor
62. Fixed resistor
63. Fixed resistor
64. Fixed resistor
65. Fixed resistor
66. Fixed resistor
67. Fixed resistor
68. Fixed resistor
69. Fixed resistor
70. Fixed resistor
71. Fixed resistor
72. Fixed resistor
73. Tube socket shield
74. Strap nut
75. Strap nut
76. Fixed capacitor
77. Chassis

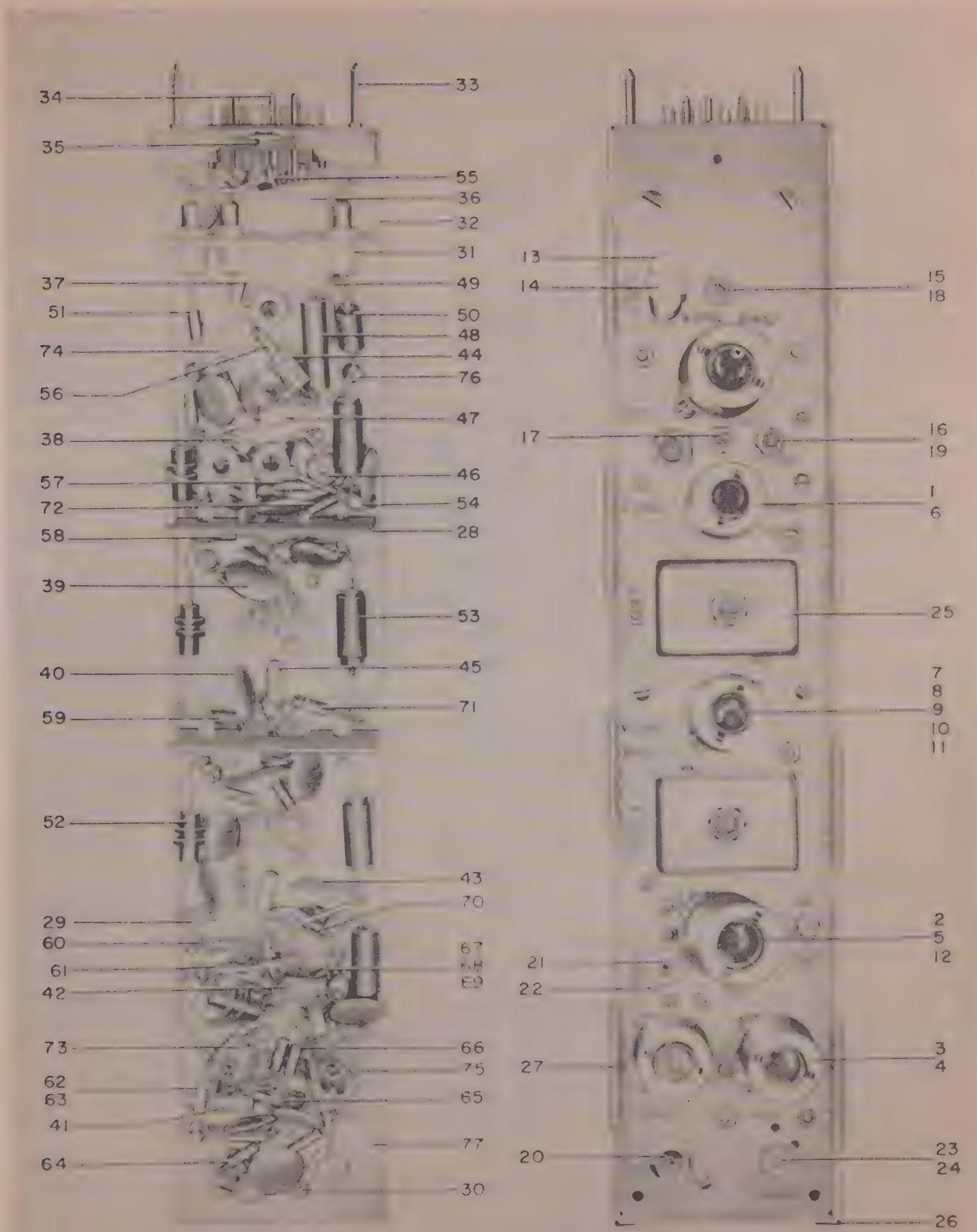


Figure 4-6. I-F Amplifier 1MC

Legend for Figure 4-7

1. Tube shield
2. Tube shield
3. Tube shield
4. Tube retainer
5. Electron tube
6. Electron tube
7. Electron tube
8. Electron tube
9. Electron tube
10. Electron tube
11. Tube socket
12. Tube socket
13. Tube socket
14. Stepped stud
15. Fixed capacitor
16. Electrolytic capacitor
17. Power transformer
18. Variable resistor
19. Variable resistor
20. Variable resistor
21. Variable resistor
22. Variable resistor
23. Variable resistor
24. Chassis handle
25. Fixed resistor
26. Fixed resistor
27. Fixed resistor
28. Fixed resistor
29. Fixed resistor
30. Fixed resistor
31. Harness wiring
32. Board terminal
33. Spacer
34. Harness wiring
35. Rubber Grommet
36. Shaft lock
37. Lock washer
38. Tip jack
39. Standoff insulator
40. Tip jack
41. Plug connector
42. Special purpose cable
43. Plug connector
44. Plug connector
45. RF cable
46. Captive screw
47. Extension spring
48. Retaining ring
49. Variable resistor
50. Variable resistor
51. Shaft lock

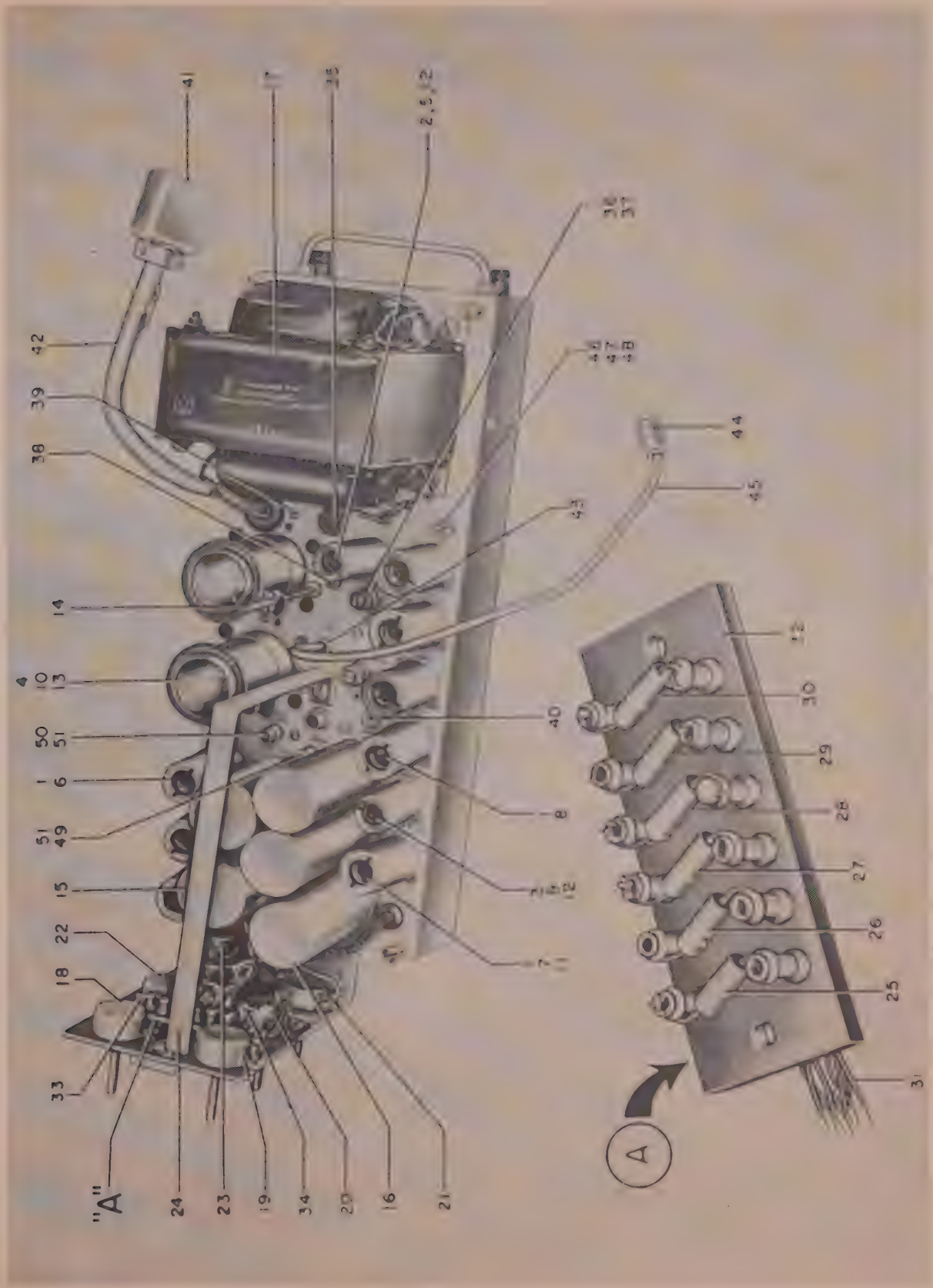
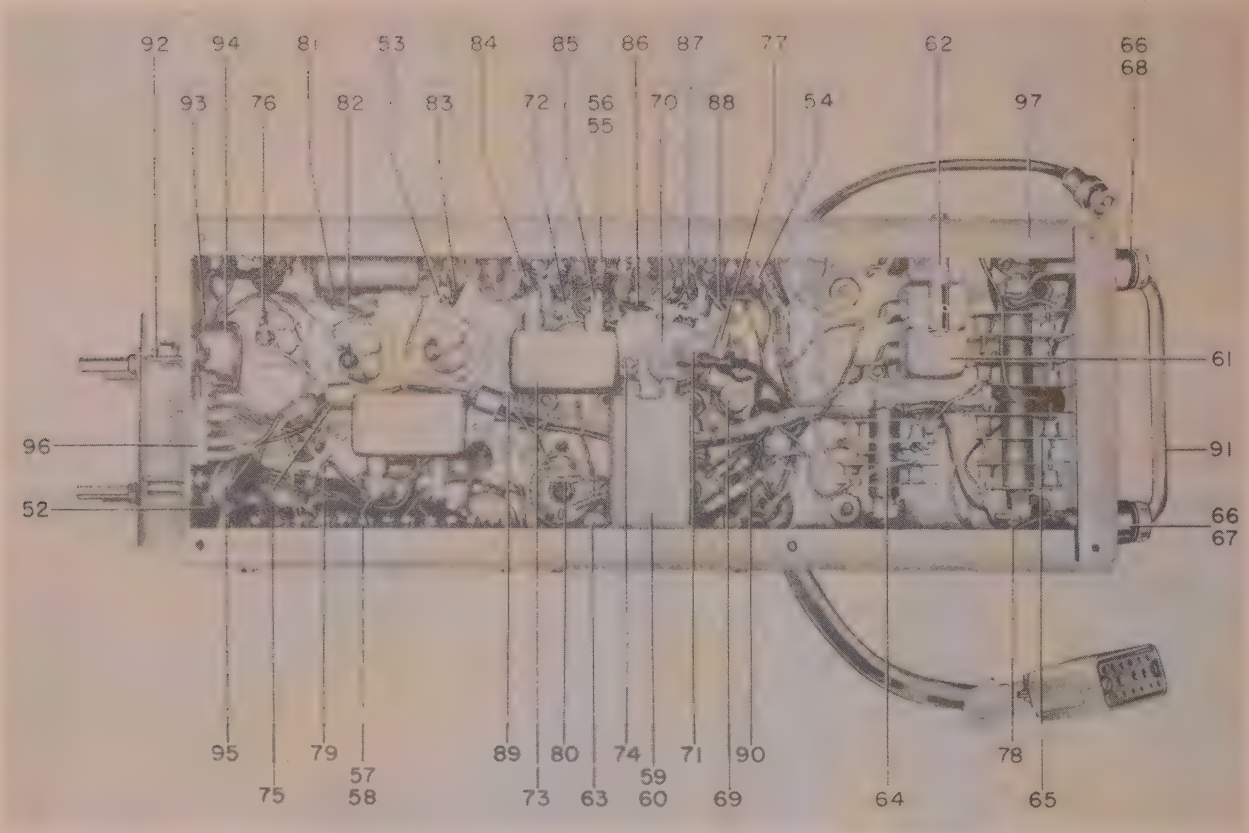


Figure 4-7. Power Supply and Video (Sheet 1 of 2 Sheets, Index Nos. 1 through 51)

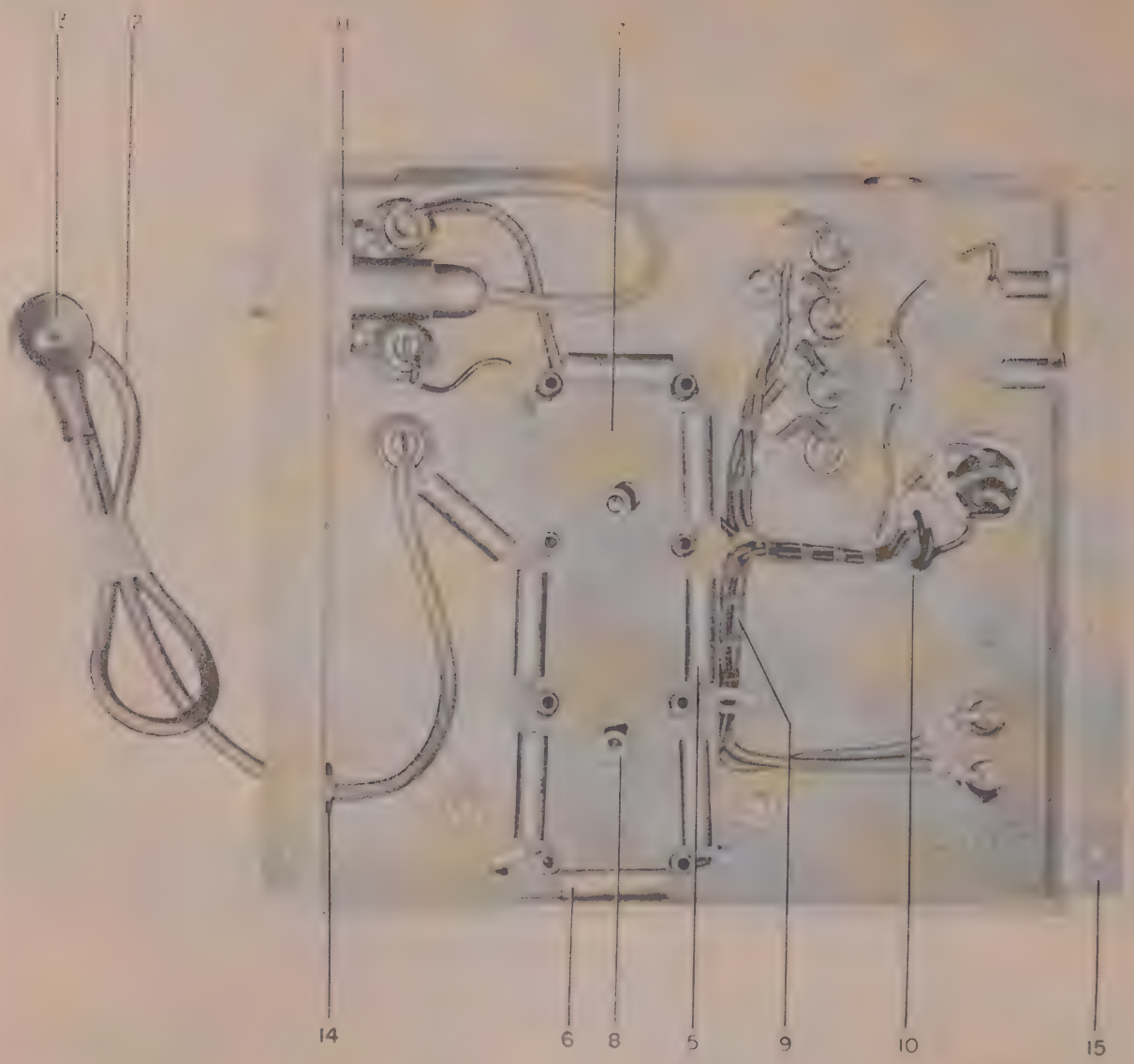


52. Rectifier crystal unit
53. Strap nut
54. Strap nut
55. Assembly resistor
56. Bushing insulator
57. Assembly resistor
58. Bushing insulator
59. Plate insulator
60. Fixed capacitor
61. Fixed capacitor
62. Fixed capacitor
63. Cable clamp
64. Rectifier crystal unit
65. Rectifier crystal unit
66. Fuseholder
67. Fuse
68. Fuse
69. Fixed resistor
70. Variable resistor
71. Fixed capacitor
72. Variable resistor
73. Fixed capacitor
74. Spacer
75. Cable clamp
76. Electrical lead
77. Fixed capacitor
78. Lug terminal
79. Electrical lead
80. Fixed resistor
81. Fixed resistor
82. Fixed resistor
83. Fixed resistor
84. Fixed resistor
85. Fixed resistor
86. Fixed resistor
87. Fixed resistor
88. Fixed resistor
89. Tip jack
90. Fixed resistor
91. Handle
92. Guide pin
93. Lug terminal
94. Variable resistor
95. Variable resistor
96. Receptacle connector
97. Chassis

Figure 4-7. Power Supply and Video (Sheet 2 of 2 Sheets, Index Nos. 52 through 97)

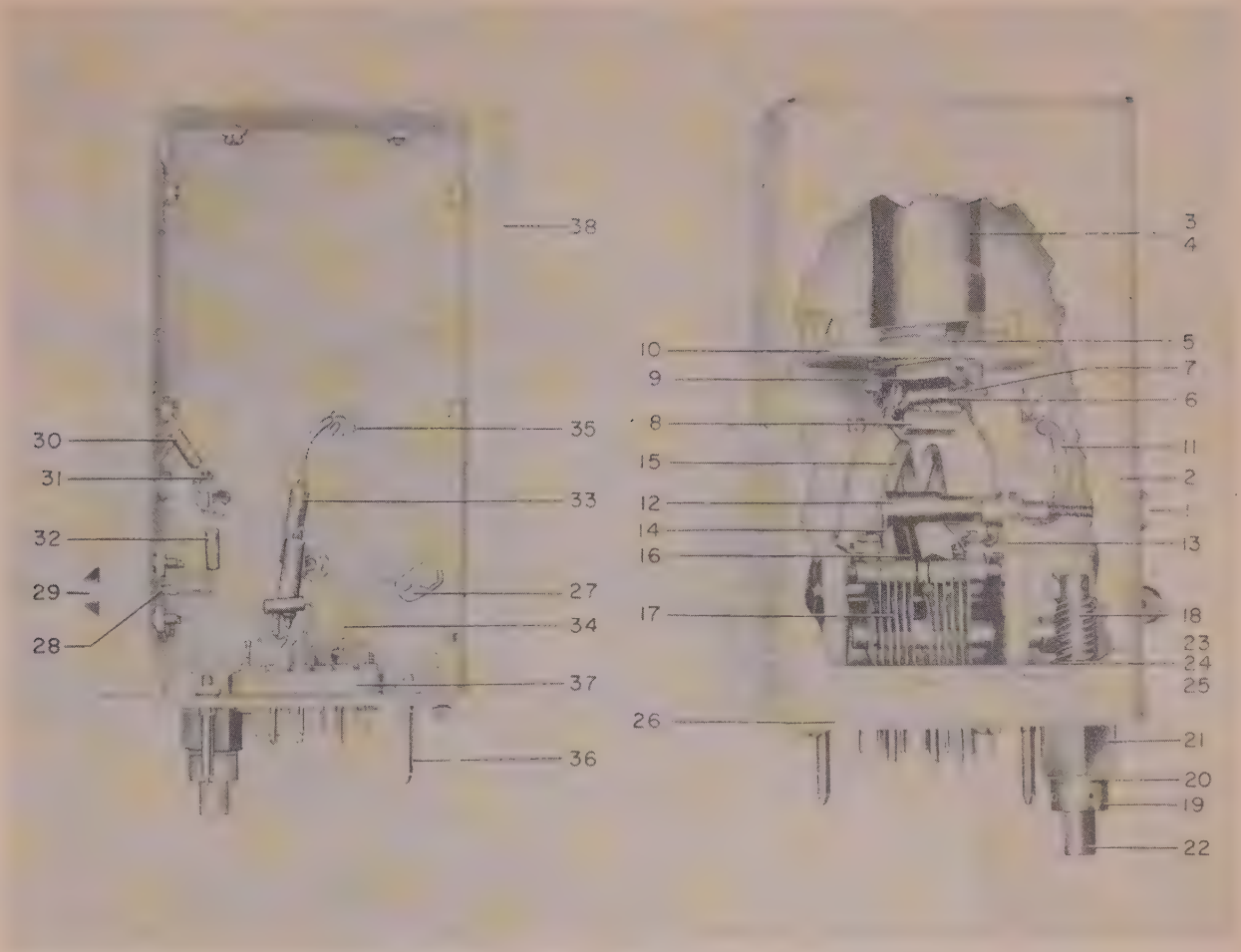
1. Power supply transformer
2. Tip jack
3. Tip jack
4. Receptacle connector

Figure 4-8. High Voltage Power Supply (Sheet 1 of 2 Sheets, Index Nos. 1 through 4)



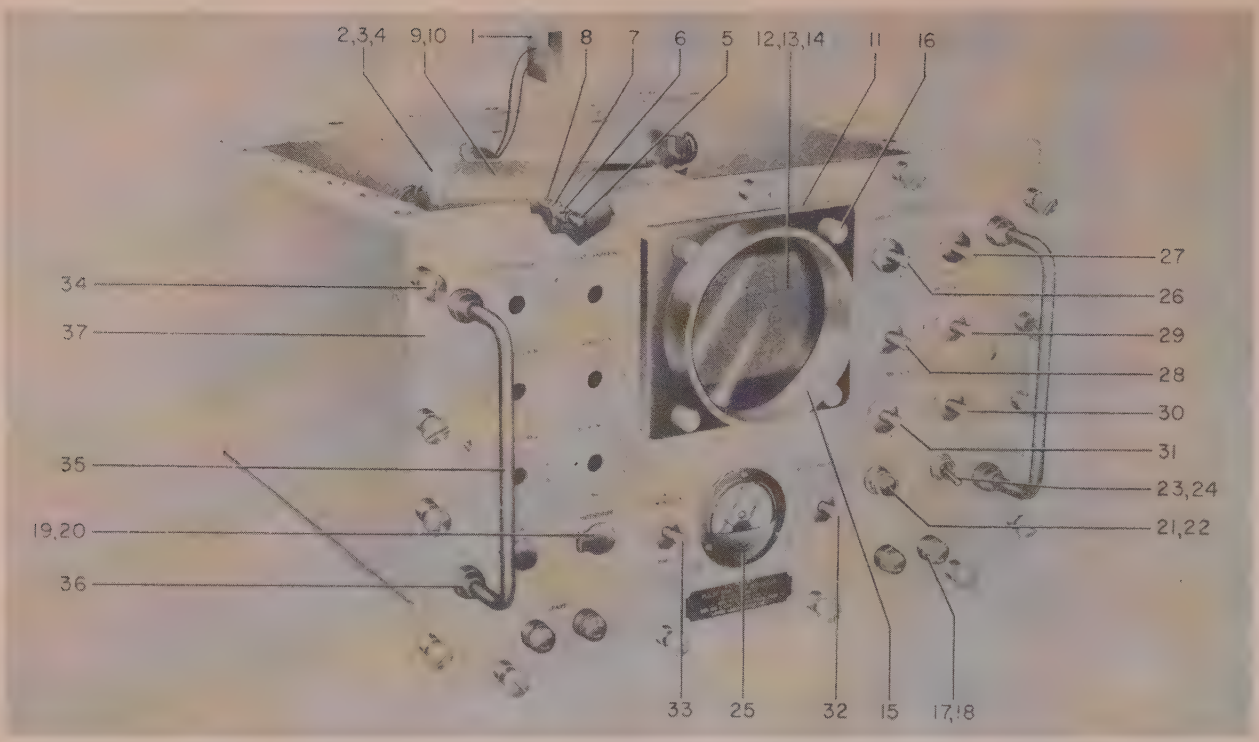
5. Fixed resistor
6. Fixed resistor
7. Board terminal
8. Bushing insulator
9. Assembly cable
10. Lug terminal
11. Receptacle connector
12. Cable
13. Electrical clip
14. Grommet
15. Chassis

Figure 4-8. High Voltage Power Supply (Sheet 2 of 2 Sheets, Index Nos. 10 through 15)



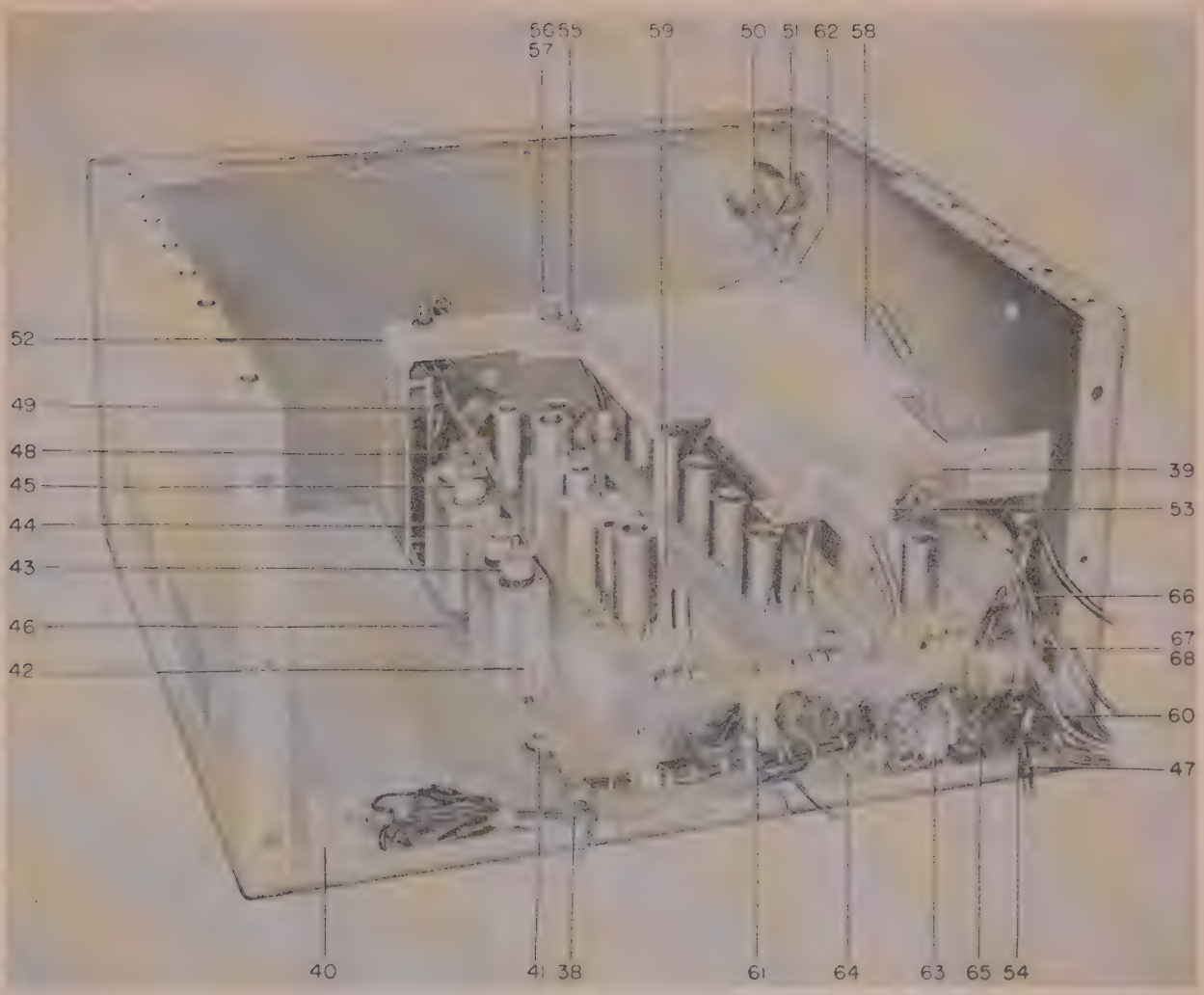
1. Electrical cap
2. Chassis cover
3. Tube shield
4. Electron tube
5. Tube socket
6. Fixed resistor
7. Fixed resistor
8. Fixed capacitor
9. Fixed capacitor
10. Tube bracket
11. Pickup coil
12. Variable capacitor
13. Mounting lug
14. Mounting lug
15. Coil
16. RF choke
17. Variable capacitor
18. Gear
19. Shaft collar
20. Plain seal
21. Sleeve nut
22. Assembly shaft
23. Washer
24. Shield bushing
25. Lock washer
26. Condenser mounting bracket
27. Lug terminal
28. Standoff insulator
29. Receptacle connector
30. Fixed resistor
31. Fixed resistor
32. Fixed resistor
33. RF Choke
34. Electrical lead
35. Fixed capacitor
36. Alignment pin
37. Receptacle connector
38. Chassis

Figure 4-9. Spectrum Calibrator



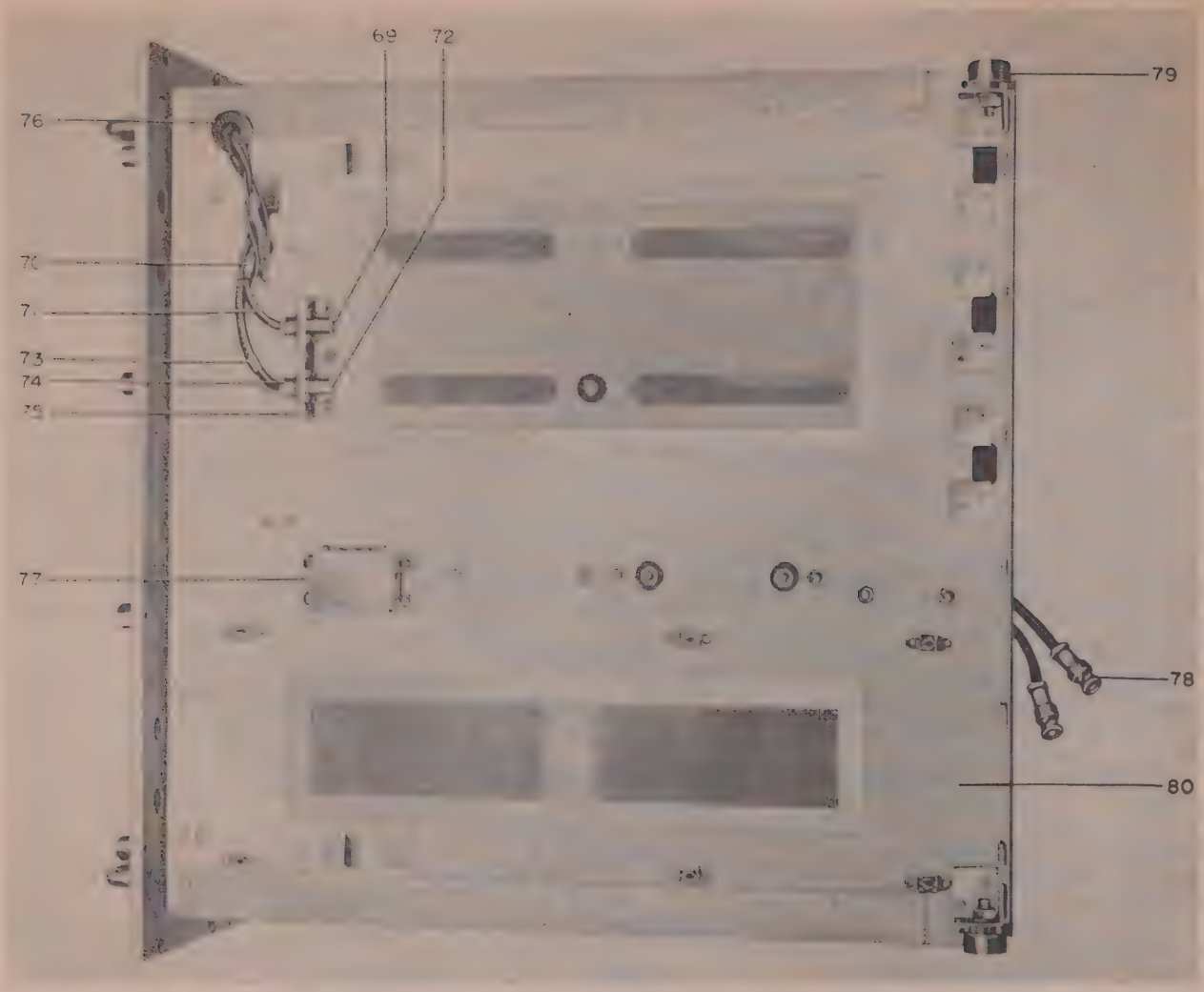
1. Connector
2. Tube socket
3. Cable clamp
4. Flat washer
5. Lamp
6. Lampholder
7. Bracket
8. Lampholder retainer
9. Tube shield
10. KRT tube
11. Bezel
12. Reticle
13. Light window
14. Filter
15. Reticle frame
16. Cap nut
17. Fuseholder
18. Fuse
19. Jack cover
20. Feedthru bushing
21. Lamp
22. Lighting fixture
23. Toggle switch
24. Rubber boot
25. Meter
26. Attenuator
27. Shield bushing
28. Variable resistor
29. Variable resistor
30. Variable resistor
31. Variable resistor
32. Switch
33. Variable resistor
34. Thumb Screw
35. Draw handle
36. Collar
37. Panel

Figure 4-10. Indicator Drawer (Sheet 1 of 3 Sheets, Index Nos. 1 through 37)



38. Harness wiring
39. Receptacle connector
40. Connector bracket
41. Grommet
42. Bracket
43. Capacitor
44. Bracket
45. Capacitor
46. Plate insulator
47. Plug connector
48. Harness wiring
49. Capacitor resistor board
50. Receptacle connector
51. Lug terminal
52. Receptacle connector
53. Resistor shield
54. Cable clamp
55. Capacitor
56. Resistor
57. Lug terminal
58. Bracket support
59. Mounting stud
60. Cable
61. Bracket assembly
62. Cable clamp
63. Resistor assembly
64. Insulator spacer
65. Variable resistor
66. Fixed resistor
67. Bracket
68. Lug terminal

Figure 4-10. Indicator Drawer (Sheet 2 of 3 Sheets, Index Nos. 38 through 68)



69. Receptacle connector
70. Identification plate
71. RF Cable
72. Receptacle connector
73. Identification plate
74. RF Cable
75. Bracket
76. Grommet
77. Connector shield
78. Plug connector
79. Insulated coupling shaft
80. Chassis

Figure 4-10. Indicator Drawer (Sheet 3 of 3 Sheets, Index Nos. 69 through 80)

Legend for Figure 4-11

1. Lamp
2. Lug terminal
3. Lug terminal
4. Contact
5. Grounding strip
6. Light mounting block
7. Harness wiring
8. Index spring
9. Dial guide shaft
10. Dial guide
11. Light guide rod
12. Light guide rod
13. Light guide rod
14. Light guide rod
15. Light guide rod
16. Light guide rod
17. Light guide rod
18. Light guide rod
19. Light diffusor
20. Light diffusor
21. Light diffusor
22. Light diffusor
23. Light diffusor
24. Light diffusor
25. Light diffusor
26. Light diffusor
27. Light diffusor
28. Light mounting bracket

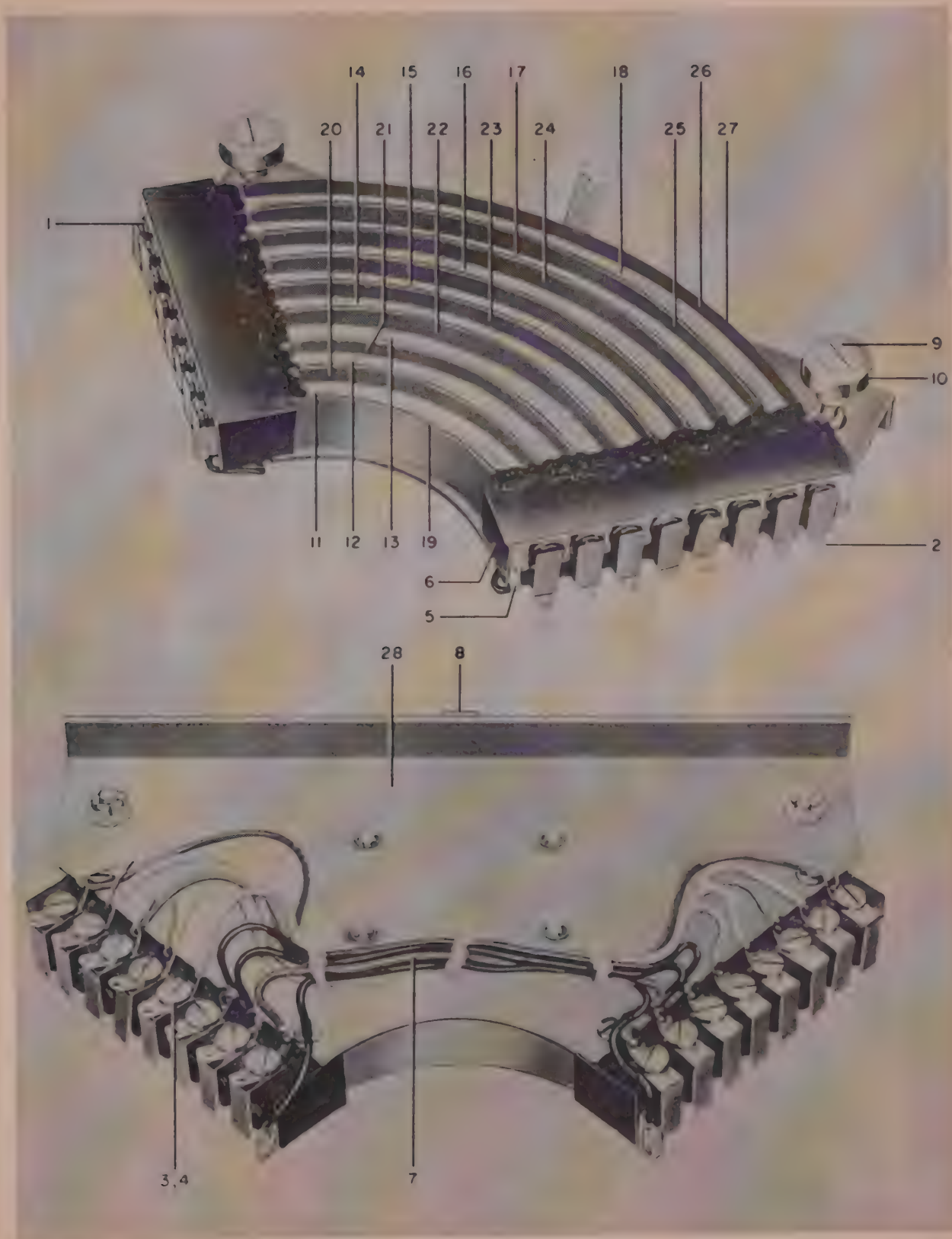
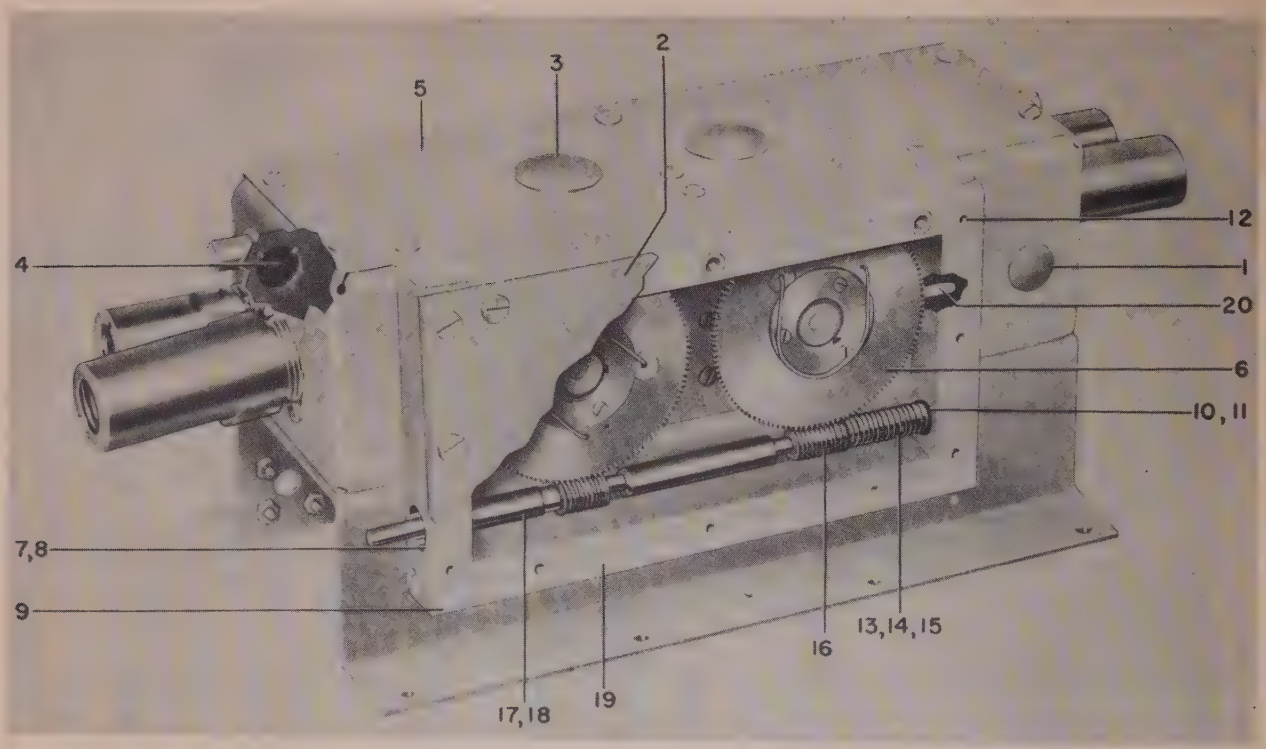
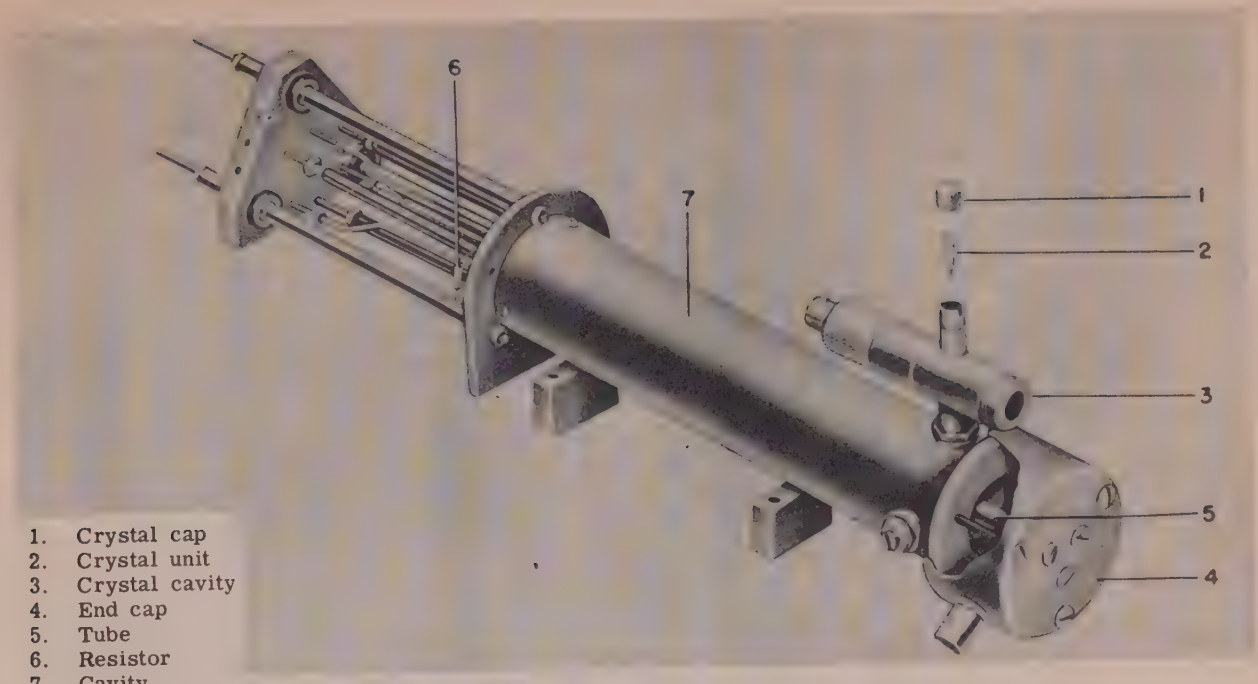


Figure 4-11. Dial Light Assembly



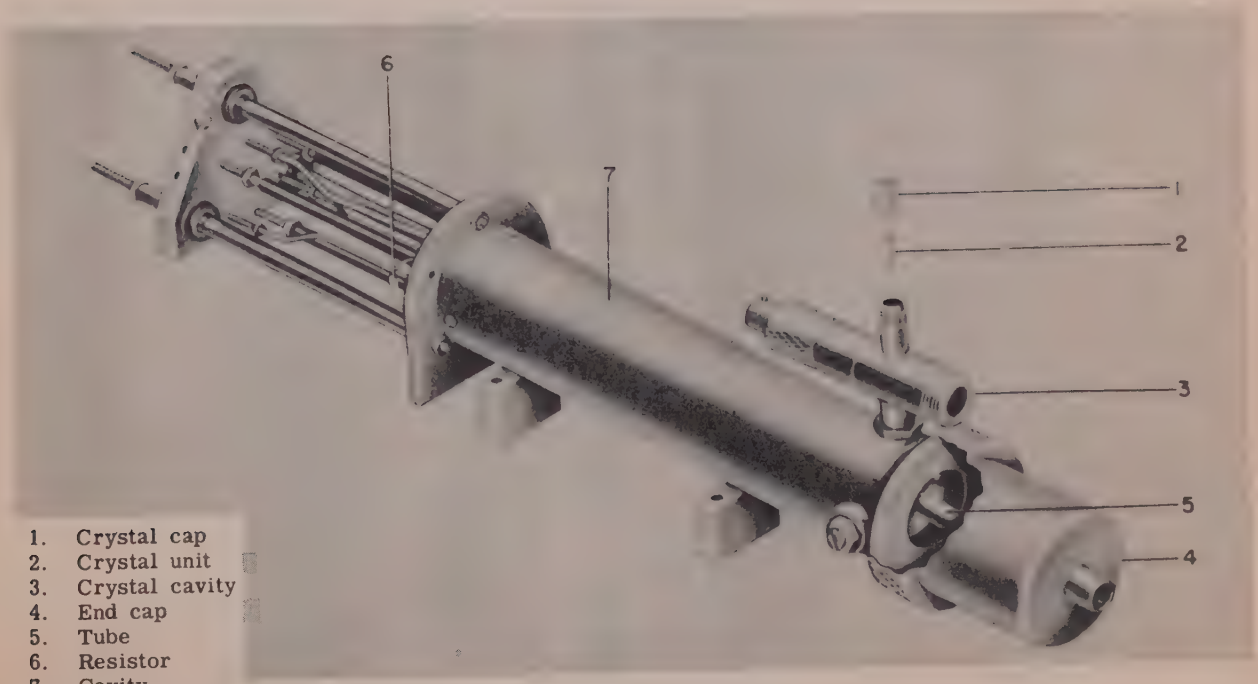
1. Access cover
2. Side cover
3. Access cover
4. Access cover
5. Top and side cover
6. Gear assembly
7. Bearing
8. Retaining ring
9. Block
10. Ball bearing
11. Retaining ring
12. Block
13. Spacer
14. Spring, tension washer
15. Collar
16. Gear worm
17. Spacer
18. Spacer
19. Spacer bar
20. Spring contact

Figure 4-12. Oscillator 1 and 2



1. Crystal cap
2. Crystal unit
3. Crystal cavity
4. End cap
5. Tube
6. Resistor
7. Cavity

Figure 4-13. Oscillator 3



1. Crystal cap
2. Crystal unit
3. Crystal cavity
4. End cap
5. Tube
6. Resistor
7. Cavity

Figure 4-14. Oscillator 4

Legend for Figure 4-15

1. Tube shield
2. Tube
3. Grounding clip
4. Amplifier cover
5. Tube socket
6. Shield base
7. Tube socket
8. Shield base
9. Tube socket
10. Shield base
11. Tuning core
12. Coil
13. Coil
14. Coil
15. Coil
16. Coil
17. Coil
18. Receptacle connector
19. Receptacle connector
20. Shaft coupling
21. Receptacle connector
22. Aligning pin
23. Fixed capacitor
24. Lug terminal
25. Wire shield assembly
26. Fixed resistor
27. Fixed resistor
28. Fixed resistor
29. Fixed resistor
30. Fixed resistor
31. Fixed resistor
32. Fixed resistor
33. Fixed resistor
34. Fixed resistor
35. Fixed resistor
36. Fixed resistor
37. Fixed resistor
38. Fixed resistor
39. Fixed resistor
40. Fixed resistor
41. Coil
42. Lug terminal
43. Fixed capacitor
44. Fixed capacitor
45. Fixed capacitor
46. Shield
47. RF choke
48. RF choke
49. Rotary switch
50. Fixed capacitor
51. Fixed capacitor
52. Standoff insulator
53. Capacitor shield
54. Chassis

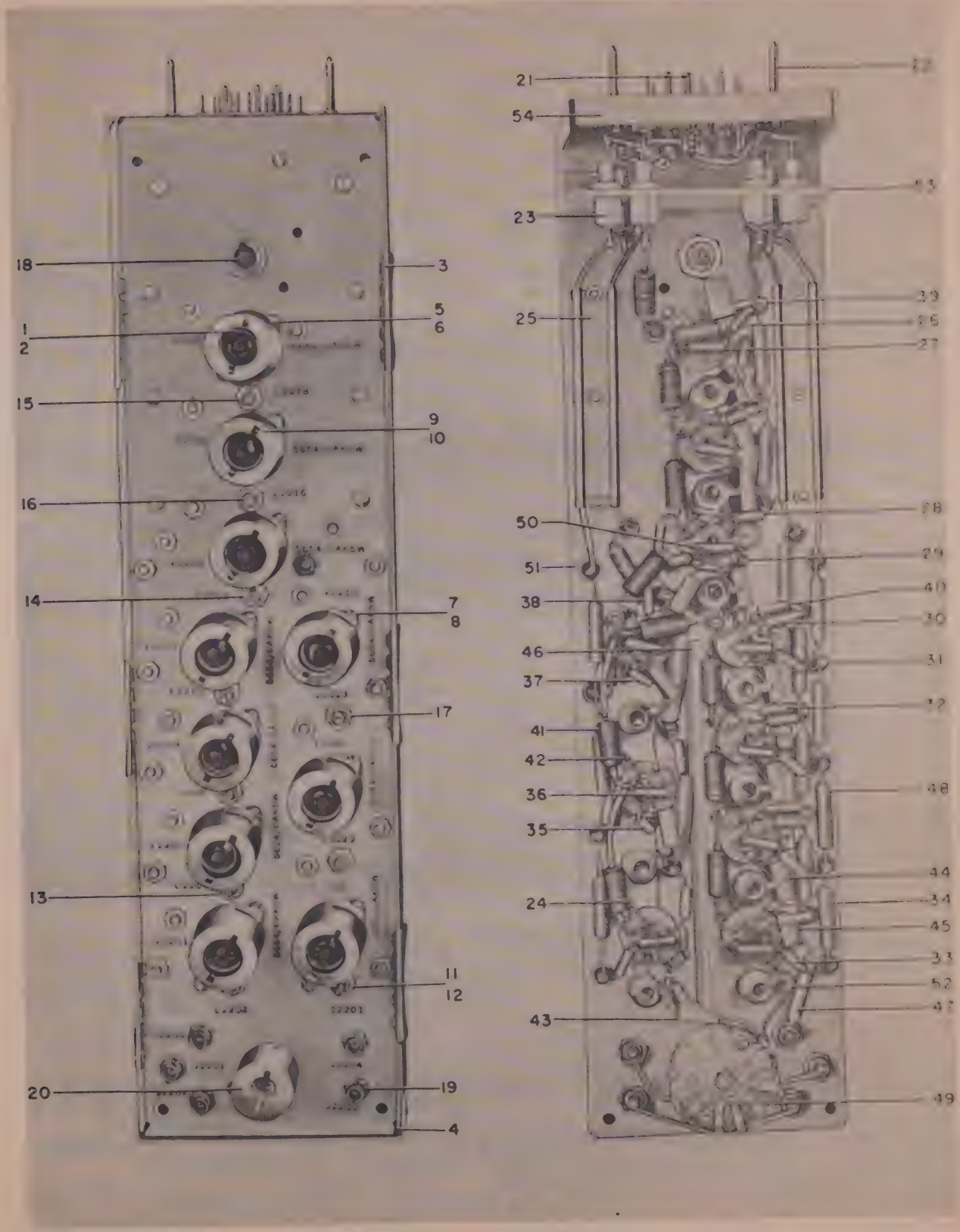


Figure 4-15. I-F Amplifier 160 MC

SECTION V

CLEANING

5-1. GENERAL.

5-2. This section contains cleaning instructions for the Spectrum Analyzer after disassembly.

5-3. SOLVENTS. Use trichlorethylene, Specification MIL-T-7003 and dry-cleaning solvent, Federal Specification P-S-661a as designated when performing the following cleaning instructions.

WARNING

Where large quantities of any solvent are used adequate ventilation must be provided. Avoid direct inhalation of the fumes or prolonged skin contact with the solvent.

5-4. CLEANING PROCEDURES.

5-5. ASSEMBLIES AND SUBASSEMBLIES. Blow away dust from the interior and exterior with approximately five psi of air pressure. Wipe with a cloth or brush moisted with dry-cleaning solvent, and then wipe thoroughly dry. Remove any corrosion with crocus cloth or No. 000 sandpaper. Remove any peeling or damaged paint with a scraper, smooth the surfaces with crocus cloth or sandpaper, and repaint with a matching color. Wipe meter cover glass, plastic covering of scope, and designation plates with a clean, dry cloth. Apply a thin coat of graphited grease, Specification VV-G-671 to the unit drawer rails.

5-6. GEAR TRAIN ASSEMBLY. Clean the gears and lead screws with a typewriter brush. Using Aeroshell Grease 7 (MIL-G-7118) on a clean fingertip, wipe the gear train and lead screws lightly.

5-7. CAVITIES. Blow away dust from the exterior with approximately five psi of air pressure. Wipe the exterior with a clean-dry cloth. Remove corrosion from contacts with crocus cloth.

CAUTION

Do not apply excessive pressure to the cavities.

5-8. TRANSFORMERS AND CHOKES. Clean metal-encased transformers and chokes with a cloth moistened with dry-cleaning solution. Remove corrosion from contacts with crocus cloth, and then polish with a clean dry cloth.

5-9. CAPACITORS. Clean the insulating bushings and cases of the large fixed capacitors and all connections which are dirty or corroded. Clean the cases and bushings with a cloth moistened with dry-cleaning solvent and then dry thoroughly. Clean corroded connections with crocus cloth or No. 0000 sandpaper. Clean the pigtail capacitors with a small brush. Moisten with dry-cleaning solvent if necessary.

5-10. FIXED RESISTORS. Clean all resistors with a brush moistened with dry-cleaning solvent. Remove ferrule resistors and clean the ferrules and the contact clips with a cloth moistened with trichlorethylene. Remove any corrosion with crocus cloth or No. 0000 sandpaper and then polish with with a clean, dry cloth. Obtain a bright, smooth finish on the contacts to insure good electrical connection.

5-11. VARIABLE RESISTORS. Do not open enclosed variable resistors. Clean the open-type variable resistors with a cloth moistened with trichlorethylene. Remove any corrosion with crocus cloth. Coat the resistor element with a thin film of grease, Specification MIL-G-3278.

5-12. ELECTRON TUBES. Clean tube envelopes with a dry cloth, or a cloth moistened with dry-cleaning solvent if necessary. Remove corrosion with crocus cloth and then polish the surface with a dry cloth. Clean contact surfaces with a cloth or brush moistened with trichlorethylene.

5-13. CATHODE-RAY TUBE. Clean the envelope and face of the cathode-ray tube with a cloth moistened with dry-cleaning solvent. Clean the pins with trichlorethylene. Remove any corrosion with crocus cloth or No. 000 sandpaper and polish with a dry cloth. Clean the high-voltage contact with a small brush.

WARNING

Use extreme care when handling the cathode-ray tube. Do not hold it by the neck. Scratching or damaging it in any way may result in imploding of the tube. Gloves and goggles should be worn to avoid injury from flying glass.

5-14. SELENIUM RECTIFIERS. Blow out the dust between the plates with approximately five psi of air pressure. Clean the contacts with a brush moistened with dry-cleaning solvent.

5-15. FUSES AND FUSE HOLDERS. Clean fuses, fuse clips, and fuse holders with a small brush. Remove corrosion with crocus cloth or No. 000 sandpaper. Polish with a clean, dry cloth.

5-16. PILOT LIGHTS. Clean pilot light jewels, base assemblies, and bulbs with a clean, dry cloth. Use a small brush on the interior of the sockets. Clean corroded contacts with crocus cloth and then polish.

5-17. CONNECTORS AND SOCKETS. Clean all connectors and sockets with a brush or cloth moistened with trichlorethylene. Clean corroded areas with crocus cloth or No. 000 sandpaper.

5-18. METER. Clean the meter case with a clean, dry cloth. Remove dirt from the mountings with a stiff brush moistened with dry-cleaning solvent. Use No. 000 sandpaper to remove corrosion, and polish with a clean, dry cloth.

5-19. SWITCHES. Clean the exterior with a dry cloth. Blow away the dust with approximately five psi of air pressure. If the connections are dirty, remove the leads and clean them with trichlorethylene. Before removing switches, make sure that no dirt, lint, or other foreign material is present which might get into the contacts. Remove dust and lint from the switch and its contacts with a soft-bristle brush.

CAUTION

Never use coarse sandpaper, emery cloth, or other highly abrasive material to clean switch contacts.

5-20. TERMINAL BOARDS AND WIRING. Blow out the dust with approximately five psi of air pressure. Clean with a dry cloth or brush. If dirt persists, use a brush moistened with dry-cleaning solvent. Disconnect any corroded connections and clean the surfaces with crocus cloth.

5-21. BUSHINGS AND INSULATORS. Clean high-voltage bushings and insulators with a cloth moistened with dry-cleaning solvent. Clean corroded mountings with crocus cloth and then polish with a clean, dry cloth.

CAUTION

Never use abrasive material on porcelain bushings or insulators as the glazed finish will be destroyed.

SECTION VI

INSPECTION OF DISASSEMBLED EQUIPMENT

6-1. GENERAL.

6-2. This section contains instructions for inspecting disassembled assemblies, subassemblies and parts for damage, wear or deterioration; also for checking them for potentially harmful conditions such as overheating, lack of lubrication, loose mountings and connections, accidental deformation, etc.

6-3. INSPECTION PROCEDURES. The inspection procedures detailed herein are of two kinds - mechanical and electrical.

6-4. INSPECTION OF MECHANICAL PARTS.

6-5. GENERAL PHYSICAL DEFECTS.

a. Examine parts to see that they are not sprung or twisted out of shape or otherwise mechanically damaged. Check for loose mountings, knobs, switches, panel screws, jacks, connectors, and unit handles. Inspect panel screw-holes to see that threads are not damaged.

b. Inspect terminal boards and wiring for burned or charred parts, cracks, breaks. Check wires for loose or broken lacing, frayed or damaged insulation. See that wire tags are legible and not defaced.

c. Examine pilot light assemblies for chipped, broken or cracked jewels, for loose connections.

d. Inspect fuse caps and mountings for charring, improper tension or loose connections.

e. Inspect meter glass, dial and KRT faces.

f. Inspect the entire equipment for evidence of overheating such as discoloration, blistering, bulging of containers or parts; breaks or cracks resulting from excessive expansion and contraction; dried out, brittle insulation, etc.

g. Examine all surfaces that have been moisture and fungus proofed to determine whether the protecting layer is still continuous or whether it needs to be touched up or replaced.

h. Manipulate all dials, switches, levers, controls, to check whether the operation of each is smooth and correct, with detents functioning properly, and without improper impediment over any part of its entire range.

i. Check proper mating of cable connectors, and freedom of connection pins and contacts from deformation. Inspect cables for fraying of insulation and shielding, cuts or other physical damage, loose cable clamps. Check cables and connectors for improper placement which might subject them to strains or kinks.

6-6. GEAR TRAIN ASSEMBLY.

a. Inspect gears and lead screws for wear. Examine the faces for straightness or any pronounced deformity. Inspect gears and lead screws for any teeth or threads that may be broken, chipped or burred. Inspect for structural damage such as cracks, fissures and dents.

b. Check that all anti-backlash gears are loaded approximately 1-1/2 teeth.

6-7. CLAMPS, COUPLINGS, COLLARS AND SMALL PARTS. Check these parts for damage and wear; determine that their screw fittings and screw threads are not worn or damaged. See that approximately equal lengths of shafts extend into both coupling hubs. Examine for bent, mutilated or stretched springs, for proper mating between pins and leaves, and that both pins and leaves are straight and free from nicks and burrs.

6-8. BUSHINGS AND INSULATORS. Inspect all high voltage bushings and insulators for chipped surfaces, hairline cracks, carbonized arc-over paths, spots where glaze has been worn off, and loose fastenings.

6-9. NAMEPLATES AND DESIGNATIONS. These shall be undamaged, and as completely legible as when factory-new.

6-10. PAINTED AND PLATED SURFACES. These shall be unabraded and unmarred.

6-11. HARDWARE. All hardware and attaching parts must be firmly secured, and firmly secure the parts to be attached or held; must be free of burrs or any cracks, splits or other damage.

6-12. INSPECTION OF ELECTRICAL PARTS.

6-13. GENERAL PHYSICAL DEFECTS. Examine all wiring for kinks or excessively sharp turns. Check all insulation for abrasion, discoloring, fraying or other visible faults. Inspect all mounting boards, terminals, insulators and panels for discolorations indicating arc-over.

6-14. ASSEMBLIES AND SUBASSEMBLIES. Test by performance, each individual assembly and subassembly. Refer to Section III for the applicable test procedure.

6-15. ATTACHING HARDWARE. Inspect visually and manually for security of physical and electrical contacts.

6-16. CAPACITORS. Examine visually for discoloration and/or leakage; check suspected capacitors with a capacitance bridge. Examine for looseness of leads and bulging of case.

6-17. CAVITIES. Check the cavities as outlined in paragraphs 3-24 through 3-31 of this handbook.

6-18. CONNECTIONS AND CONTACTS. Inspect visually, measure resistance of doubtful contacts with a Wheatstone bridge.

6-19. ELECTRON TUBES. Examine terminals, connections and tube shields for looseness. Check tube pins and socket contacts. Check the tension of tube clamps; inspect wire leads for frayed insulation and broken strands. Test all standard tubes in a standard tube tester.

6-20. INDUCTORS AND TRANSFORMERS. Inspect visually for loose terminals, and for leakage of insulating compound or oil. Check doubtful inductors with ohmmeter or with a-c bridge.

6-21. METER. Inspect for damaged or broken plastic cases. Check zero position of pointer.

6-22. POTENTIOMETERS. Check manually for smooth action over full scale; test doubtful potentiometer for electrical performance with an ohmmeter. Examine the resistance elements and contact arms of open-type resistors. See that they are not worn and check the resistance element for signs of overheating. Check the tension of the wiping arms. The arms must make good contact without being excessively tight as to damage the resistance element. On wirewound elements, see that there are no broken wires and that no wires cross over each other. Inspect all metal parts, mounting, and connections for dirt, looseness, and corrosion. See that there is no binding or looseness in any of the moving parts. Do not open the enclosed type of variable resistor; if manual manipulation or ohmmeter test indicate its condition is doubtful, replace it.

6-23. RECEPTACLES AND SOCKETS. Check for resistance-free contact at all points, and for absence or deformation of pins, leaves or prongs.

6-24. SELENIUM RECTIFIERS. Check by performance test; in any case of doubt read conductivity in both directions with an ammeter or milliammeter.

6-25. RESISTORS. Examine fixed resistors for dirt, cracking, chipping and signs of overheating. Blistering and discoloration are indicative of overload. Check the color-code values of suspected resistors with a suitable ohmmeter. Examine clips and the metallic ends of ferrule resistors for corrosion, dirt, or damage. Inspect the mountings for insecure fastening. Check the spring tension of ferrule clips by testing the pull of the ferrule resistor; insufficient pull at the clip indicates poor clamping, which may result in poor electrical contact.

6-26. SWITCHES. Inspect switches for loose mountings and connections. Examine the contacts for pitting. Test their action and see that they operate without binding. In gang and wafer switches, see that the movable blade makes good contact with the stationary member. Make sure that the stationary contact leaves spread as the movable blade slides into them.

6-27. VARIABLE CAPACITORS. Check for smooth action over the entire scale; test suspected variable capacitors for possible short circuit at any position over entire scale.

SECTION VII

REPAIR AND REPLACEMENT

7-1. GENERAL.

7-2. This section contains instructions for the repair or replacement of unserviceable parts. No repair procedures are given for those parts which (impractical to repair or overhaul) are normally replaced as units.

7-3. REPAIR AND REPLACEMENT.

7-4. Many electronic parts, including electronic tubes, resistors, capacitors, fuses, switches indicator lamps, and sealed parts such as transformers, inductors, etc. are not economically repairable, but when defective shall be replaced. Mechanical parts such as worn gears, bent shafts, defective or deteriorated fabrications, etc., also can be much more economically replaced than they can be repaired, and replacement rather than repair will be the normal procedure with respect to all such items whenever they need attention.

7-5. GEAR TRAIN ASSEMBLY. If any part of the gear train assembly is defective, replace the entire gear train assembly.

CAUTION

Do not attempt to repair the gear train assembly.

7-6. CAVITIES. If any part of either cavity assembly is defective, replace the entire cavity assembly.

CAUTION

Do not attempt to repair either cavity.

7-7. CABLES AND CONNECTORS. To replace a cable, cable connector, or both, fabricate as necessary using the defective cable assembly as a guide.

NOTE

Tag all wires at each end, as required, for future identification.

7-8. In the case of single pin coaxial connections and single conductor cables use the following procedure:

a. Loosen the insert locking screw and the grounding screw and disassemble the connector.
b. Prepare the cable.
c. Slip the spring over the cable and solder it to the braid so that 1/8 inch of the inner insulator extends beyond the spring and braid.
d. Slip the connector barrel over the cable and feed the conductor through the hollow pin until the inner insulation touches the contact insert.
e. Solder the conductors to the contact at the tip.
f. Reassemble the connector by screwing the insert locking screw into the hole in the contact insert, and the grounding screw firmly against the spring.

7-9. RETROPICALIZATION.

7-10. GENERAL. The application of the moisture- and fungus-resistant finish, Specification MIL-Y-173A-Type 1, is intended to accomplish the following purposes:

a. Render the surfaces moisture-resistant.
b. Cover the terminals and connections with a low moisture-absorbing film that minimizes surface electrical leakage and arc-overs.
c. Retard moisture absorption.
d. Promote corrosion retardation.
e. Prevent fungus growth.

7-11. The finish is to be applied thoroughly and completely to those surfaces that support such circuit elements as resistors, capacitors, coil, etc., and to all circuit elements including interconnecting wiring and connections, where the application does not interfere with the operation and performance of the equipment. Included are:

a. Cables, cordage, braid-covered cables, cable forms, lacing cord, wire, etc., that are inside a component and not normally flexed during operation. After installation of the laced forms and the soldering of wires to their terminals, the wire ends (that is, the bare wire, adjacent textiles, servings, tie cords and soldered terminals) should be covered with the finish. In congested locations, the finish should be applied when the wires are connected.
b. Fixed capacitors (under 600 volts operating).
c. Bottom and top chassis except where the metal is placed or finished in accordance with U.S. Government Specification 72-53.
d. Chokes and coils.
e. Joints between dissimilar metals and nonvarnished or nonpainted metallic surfaces, including shield cans, cases, and covers, except those plated or finished as designated in item c, above.
f. Pile-up portions of jacks, relays, and switches.
g. Fixed resistors (except those hermetically sealed).
h. Tube socket (except the contacts).
i. Soldered joints (including adjacent wire insulation and terminal boards).
j. Terminal boards.
k. Terminals, screw lugs, and soldered connections.

7-12. EXPOSURE OF PARTS. Expose the parts to be covered so that the finish may be applied over the surfaces to be treated. Remove the case, cans, covers, shields, etc. of assemblies if the subassemblies are not previously treated. Where practicable, bend back untreated cables, and loosen untreated terminal boards to expose their undersides.

7-13. CLEANING. All surfaces to be coated must be free from dirt, oil, grease, or other foreign matter that will prevent the proper adherence of the material. Remove all visible deposits of rosin. Joints having visible rosin deposits need not be cleaned.

NOTE

Do not use alcohol or acetone as a cleaning agent as they tend to spread a thin coat of rosin over a large area.

7-14. MASKING. Use masking tape, jigs, metal, or cardboard fixtures, etc. to mask all surfaces that need no coating. Use dummy tubes to mask tube sockets, but do not remove them until the material has dried hard, as the tube prongs may draw the coating material into the socket contacts.

7-15. PREHEATING. The material must be applied to dry surfaces only. If preheating is required to eliminate surface moisture, temperatures must be kept below a level that causes damage at a rate slow enough to avoid shrinking, cracking, warping, or other deterioration. The preheating of assemblies having waxed encased parts is not to exceed 60°C (140°F), the approximate temperature at which all assemblies should be preheated. The preheating-time period should be sufficient to dehydrate the assembly.

7-16. APPLYING. Parts requiring treatment and which cannot be coated properly after installation should be coated prior to assembly. Apply the finish by spraying, brushing, or dipping in such a manner that the dried film is smooth and free of defects, such as bubbles, wrinkles, filament, or spray dust. Avoid running, lumping, or drops. The dried coat should be at least 0.002-inch thick. where practicable.

7-17. DRYING. The recommended material dries to the touch in 15 minutes and dries hard in one hour. However, air-dried assemblies should be given 48 hours before they are put into service.

7-18. MARKING OF TREATED EQUIPMENT. Each component should be permanently and legibly marked "MFP" by stenciling, rubber stamp, or decalcomania.

SECTION VIII

REASSEMBLY AND TESTING

OF

SUBASSEMBLIES AND ASSEMBLIES

8-1. GENERAL.

8-2. This section describes the procedures for reassembling mechanical detail parts into subassemblies, and reassembling the subassemblies into assemblies. Performance tests required after reassembly are contained in paragraphs 3-10 through 3-67.

8-3. REASSEMBLY.

8-4. INDICATOR DRAWER. Reassemble the indicator drawer in the reverse order of the disassembly procedure given in paragraph 4-11. To reassemble all electrical parts of the indicator drawer refer to the appropriate schematic wiring diagram contained in the Handbook of Service Instructions.

8-5. PULSE ANALYZER INDICATOR IP-130/UPM-17 ASSEMBLIES. Reassemble all electrical and mechanical parts of the six assemblies of the pulse analyzer indicator. The six assemblies referred to are listed in paragraph 4-10. Reassembly is essentially the reverse of disassembly. To reassemble the electrical parts of each assembly unit refer to the appropriate schematic wiring diagram contained in the Handbook of Service Instructions.

8-6. R-F TUNER TN-188/UPM ASSEMBLIES. Reassemble all disassembled parts of the five assemblies of the r-f tuner. The five assemblies to be reassembled are the dial light assembly, oscillator 1 and 2, oscillator 3, oscillator 4, and the 160 mc i-f amplifier. Reassembly is essentially the reverse of the disassembly procedures given for the five assemblies in paragraph 4-12. To reassemble the electrical parts of each assembly unit refer to the appropriate schematic wiring diagram contained in the Handbook of Service Instructions.

8-7. TESTING.

8-8. PULSE ANALYZER INDICATOR IP-130/UPM-17 ASSEMBLIES. Upon completion of reassembly, test each of the six assemblies according to the applicable test procedures outlined in paragraphs 3-40 through 3-67.

8-9. R-F TUNER TN-188/UPM ASSEMBLIES. Upon completion of reassembly, test each of the five assemblies according to the applicable test procedures outlined in paragraphs 3-10 through 3-39.

8-10. POINTS OF LUBRICATION.

8-11. Lubricate the following items every 500 hours, or before reassembly, using MIL-G-7118 lubricant, or equivalent:

a. Gear Train Assembly
b. Pawls
c. Worm gear on oscillator 1 and 2
d. Worm gear on spectrum calibrator
e. All bearings.

SECTION IX

REASSEMBLY AND TESTING OF COMPONENTS

9-1. GENERAL.

9-2. This section describes the procedures for reassembling all assemblies into the indicator drawer and the tuner drawer components. Performance tests required for the completely-assembled indicator drawer (Pulse Analyzer Indicator IP-130/UPM-17) and the completely-assembled tuner drawer (R-F Tuner TN-188/UPM) are contained in the Handbook of Service Instructions.

9-3. REASSEMBLY.

9-4. PULSE ANALYZER INDICATOR IP-130/UPM-17. Reassemble the six assemblies of the pulse analyzer indicator into the indicator drawer in the reverse order of the dismantling procedure given in paragraph 4-7. Reassembly is essentially the reverse of disassembly. The six assemblies consist of the sweep frequency generator, the 64 mc i-f amplifier, the 1 mc i-f amplifier, the power supply and video chassis, the high voltage power supply and the spectrum calibrator.

9-5. R-F TUNER TN-188/UPM. Reassemble the five assemblies of the r-f tuner, plus the gear train assembly, into the tuner drawer in the reverse order of the dismantling procedure given in paragraph 4-8.

9-6. TESTING.

9-7. Refer to the Handbook of Service Instructions for the applicable test procedure covering the indicator and r-f tuner drawer components.

SECTION X

FINAL REASSEMBLY

10-1. GENERAL.

10-2. This section describes the procedures for reassembling the Pulse Analyzer Indicator IP-130/UPM-17 and the R-F Tuner TN-188/UPM into the instrument case to form the complete spectrum analyzer.

10-3. FINAL REASSEMBLY.

10-4. Replace the Pulse Analyzer Indicator IP-130/UPM-17 and the R-F Tuner TN-188/UPM into the instrument case by reversing the procedures given in paragraph 4-6.

SECTION XI

INSPECTION, TESTING AND PACKAGING

11-1. GENERAL.

11-2. This section describes the procedures for inspecting and packaging the spectrum analyzer. All test procedures are covered in Sections III and IX.

11-3. INSPECTION.

11-4. Make the final inspection of the spectrum analyzer as follows:

a. Check the general appearance, paint and hardware.

b. Check that all plug connectors and receptacles are secure.

c. Check that the covers mount properly. Inspect the hardware for proper fastening. Make sure there is no interference with wiring or parts.

11-5. TESTING. Refer to Sections III and IX.

11-6. PACKAGING.

11-7. Replace the spectrum analyzer into the transit case by following the procedures given in paragraph 4-3, in reverse order.

SECTION XII

DIFFERENCE DATA SHEETS

12-1. GENERAL.

12-2. No Difference Data Sheets are necessary at this time. Difference Data Sheets will be added when necessary by revisions.

TITLE	ILLUSTRATION	CLEANING	DISMANTLING	DISASSEMBLY	INSPECTION	REASSEMBLY	REPAIR REPLACEMENT	TESTS
Filter Strip P/N 8340030	--	54	--	--	56	--	58	22
High Voltage Power Supply P/N K95800030	43	54	--	32	56	60	58	28
I-F Amplifier 1 MC P/N K9010070	39	54	--	32	56	60	58	23
I-F Amplifier 64 MC P/N K9010060	37	54	--	32	56	60	58	23
I-F Amplifier 160 MC P/N K90100080	53	54	--	33	56	60	58	20
Indicator Drawer Assembly P/N K94000020	46	54	29	32	56	61	58	23
Oscillator 1 and 2 P/N K95400070	50	54	--	33	56	60	58	17
Oscillator 3 P/N K95400080	51	54	--	33	56	60	58	18
Oscillator 4 P/N K95400090	51	54	--	33	56	60	58	19
Power Supply and Video P/N K95800020	41	54	--	32	56	60	58	26
R-F Tuner Drawer Assembly P/N K98800050	32	54	29	32	56	61	58	14
Spectrum Calibrator P/N K95400060	45	54	--	32	56	60	58	27
Sweep Frequency Generator P/N K95400050	35	54	--	32	56	60	58	24